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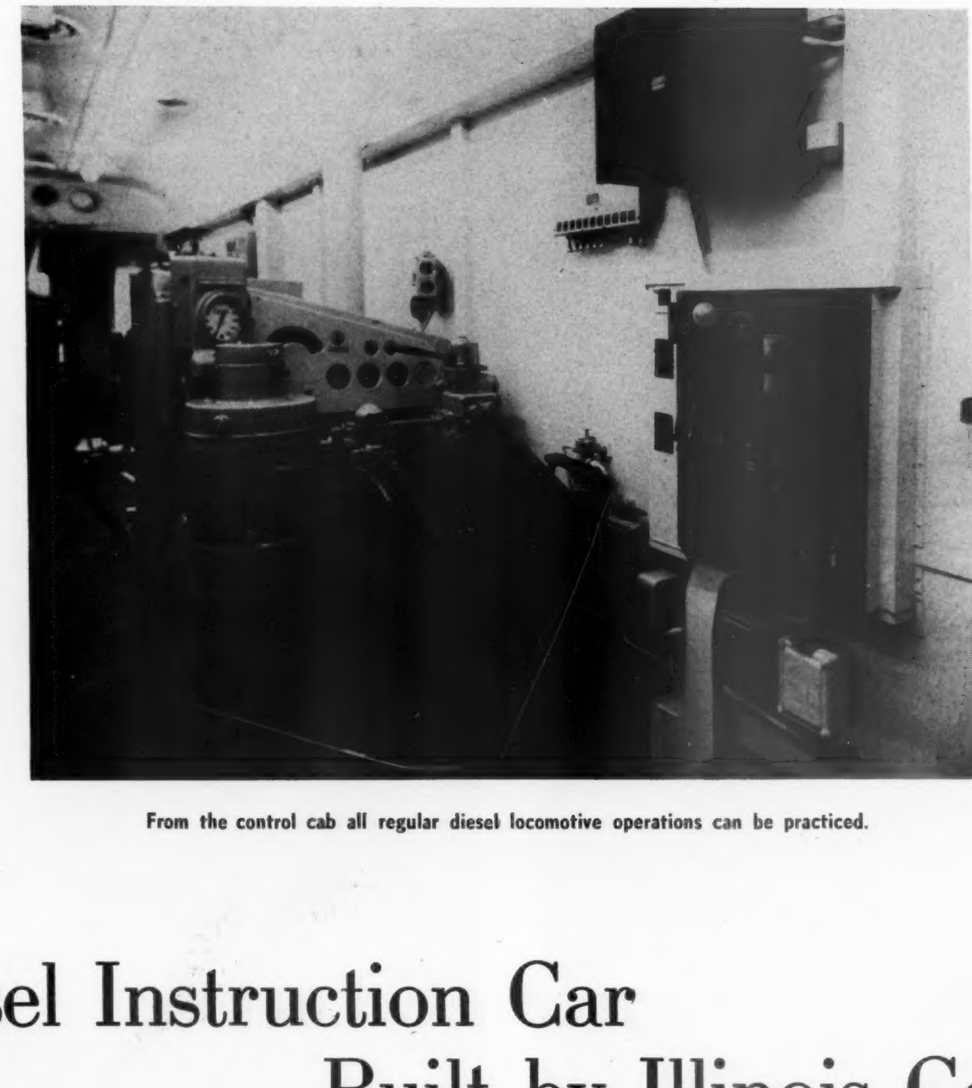


From the control cab all regular diesel locomotive operations can be practiced.

Diesel Instruction Car Built by Illinois Central

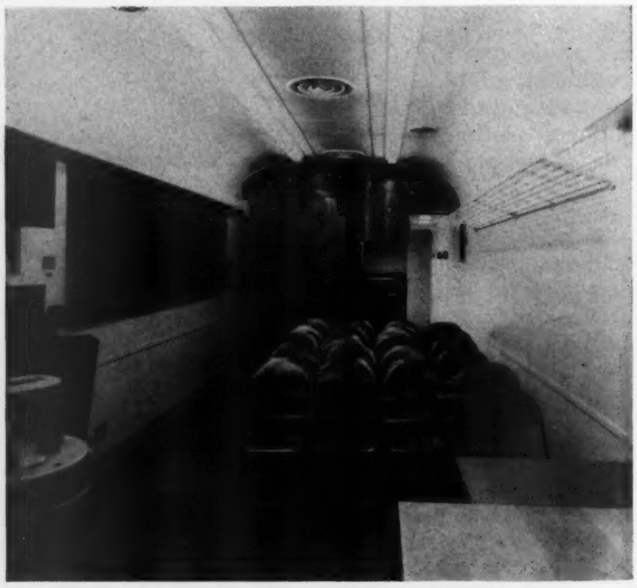
With its diesel fleet numbering 30 passenger units and 139 switchers, the Illinois Central decided that the expense of building a diesel instruction car would be a good investment to reduce train delays and to improve generally the efficiency of diesel operation. The work was undertaken at the I. C. Burnside shops in Chicago. In the design of the car, which was converted from a combination baggage-coach, maximum use was made of scrap materials and as many parts as possible were made to perform two, and in some cases, three functions.

The car has a complete set of locomotive cab controls, from which the operation of a diesel locomotive can be simulated. While the engineer is at his controls simulating normal operation of a diesel locomotive, an instructor operating a panel of 30 switches can produce any problem normally encountered in diesel operation. By throwing a switch the instructor can duplicate such conditions as wheel slipping, blown fuses, ground relay operation, lack of fuel or a stopped-up fuel filter.

An electric control cabinet similar to that found in a diesel locomotive controls the various circuits activating the training mechanisms. Power to activate these mechanisms has been reduced from 600 to 64 volts. The car is equipped completely for electrical trouble shooting, with all electrical equipment live and working. Some of the larger pieces of electrical equipment had to be scaled

In front of the control cabinet is mounted the trick panel with 30 switches to duplicate problems normally encountered in diesel operation.

A steel disc ½ in. by 36 in. simulates the inertia of the train the student engineman is operating from the control stand. To the left is the scrap tie tamper motor representing the diesel engine mounted on top of the simulated main generator.



The car from the instructor's lecturing area with the cabinet space in the background. When the projector shelf *S* is lowered it is supported through the two support blocks *B* by opening the two locker doors *D*.

down, but wherever this was done the model operation simulates the operation of the actual locomotive equipment.

The accessory end of a diesel engine is mounted along one wall of the car. This installation contains working mechanisms of the overspeed trip, a throttle, models of water and lubricating oil pumps, and a governor. A cut-away section of a diesel engine is mounted along the opposite wall. The sections are painted in various colors to indicate air passages, fuel flow and exhaust. The position of the pistons, rings and gaskets is clearly visible.

A revolving wheel mounted on the floor in front of the engineer's diesel controls has sufficient inertia to represent the movement of the drive wheels, enabling braking and other operating conditions to be observed.

In one end of the car is a steam generator room in which the steam lines, fuel lines and various circuits are painted in different colors to trace a line or circuit. The

other end has a classroom section seating 18 people on folding chairs with padded seats and backs. A blackboard, bulletin board, public address system, and 16-mm. sound motion picture projection equipment complete with rewind and storage space are among the facilities used in training. Ample storage space for literature, file cabinets for instruction manuals and a desk are also in the classroom area. In fact, lockers were installed in every nook where space could be found. A telephone which may be plugged into wayside circuits is also part of the car's equipment.

A private office with a divan that makes into an upper and lower berth is located behind the classroom section and is for the use of the diesel car instructor. The car is air conditioned and equipped with 22 25-watt 4500-deg. white fluorescent fixtures. These furnish a light intensity of 29 foot candles on a 45-deg. plane 33 in. above the floor, or 35 foot candles on a horizontal plane. These were installed so that the class could see into recesses without needing a flashlight. Floors are covered with asbestos tile and the interior is finished in a pastel yellow in the classroom section, grey in the steam generator room, and tan in the stateroom.

Two Primary Ideas in Layout

Two basic ideas were followed in laying out the car. First, as much actual locomotive equipment as possible was used; where the actual equipment was impractical to install, model equipment was used which simulated the operating characteristics of the actual equipment. Second, everything instructional either works like the comparable equipment on a locomotive, or at least sound the same. The car was also designed to be adaptable to changes that might be found desirable from experience, and to changes that might be necessitated by future changes in design of diesel locomotives.

Before undertaking the building of the diesel instruction car, the I. C. made a careful study of all details which they felt should be built into the car, including minor ones. Some of the features decided upon were learned from studying existing cars on other railroads, while others were new ones developed by the railroad.

Cutaway models and other instructional exhibits were placed right next to the wall, keeping them back out of the passage ways as much as possible and leaving open space around them. The office is incorporated in the sleeping room which can be locked. Thus, if the instructor is making out reports or doing other paper work and someone comes in and asks a question which requires leaving his desk to answer, there is never any need to put away the papers he is working on. He merely locks the door to eliminate any risk of his work being misplaced by others who may happen to enter the car. When he is ready to resume work, everything is right in front of him in the proper order as when he left it.

The film magazine is built in; the film locker and the rewind shelf were carefully laid out following principles learned by theI. C.'s Audio-Visual Aids Department in over eight years of experience. The problem of supporting the projector shelf had a particularly interesting solution. The shelf is hinged at the bottom so that it both supports the projector while in use and serves as a door to lock the projector up when it is not in use. When showing pictures the projector had to be easily accessible from both sides and from the front. Therefore cable struts were not feasible.

The solution was both simple and effective. The locker space under the projector shelf was enclosed by two doors, both of which were hinged at the outside edges. A support block was fastened to each of the edges of the projector shelf near the outside corners. When movies or slides are to be shown, these two doors are opened and firmly support the shelf and heavy projector through the support blocks.

To avoid loud blares in some parts of the car and dead spots in others, the public address system has six speakers distributed along the ceiling area. The motion picture amplifier serves also as the PA system amplifier. Microphones can be plugged into any of four strategically located wall receptacles to keep cord lengths to a minimum. Another safety factor is the installation of two aisle lights along one side of the seating area for movement when the car is darkened.

In addition to the desk in the stateroom, there is a combination desk and work bench in the main body of the car with a file cabinet on either side. These three units were laid out with the tops at the same height for spreading out large blueprints. Having the file cabinets next to the work bench is also handy for getting prints and instruction books.

Changes in the Exterior

All but six of the windows in the passenger compartment of the baggage-coach were closed off for several reasons. Without windows distraction to members of the class is reduced to a minimum. A dark room for showing pictures is easily and quickly attained by merely switching the lights off. More wall space is available for charts, and exhibits can be more conveniently installed. The continuous wall also permitted installing the blackboard along one side of the class seating area where it does not interefere with movement between the two ends of the car nor with the installation of large exhibits. At the same time the board can be easily seen by the students by merely turning their heads.

Two new windows were installed for ventilation in the steam generator room, which occupies the space formerly devoted to baggage on the combination car. This room is partitioned off from the remainder of the car by collapsing doors. The outside baggage doors were left as they were for handling large equipment.

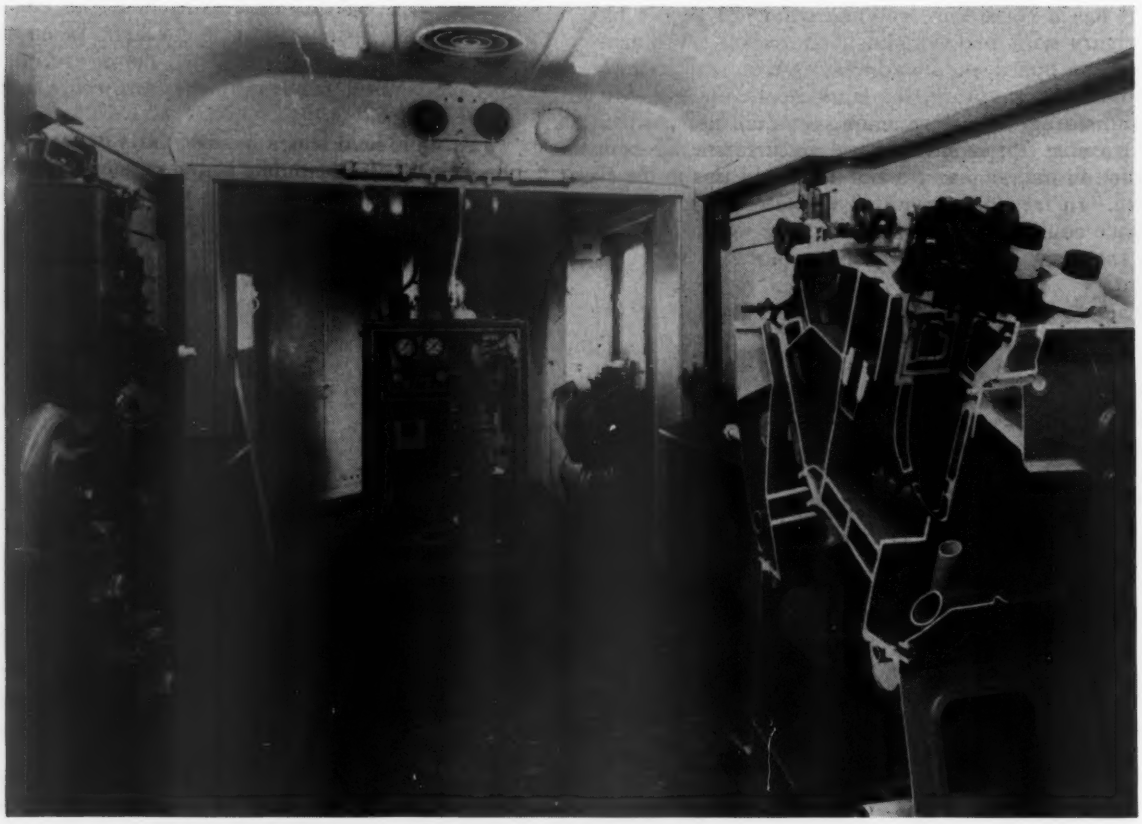
Service Equipment on the Car

The car is equipped to make it completely self-sufficient except for fuel and water. It has a standard General Electric 30-kw. under-car power plant driven by a six-cylinder diesel engine. Receptacles are installed to receive 220-volt three-phase current. The 64-volt d.c. power for controls and for battery charging is furnished by a 10-kw. motor-generator set. Battery power is for emergency lighting and cranking the under-car diesel engine only. As a result, only one 168 ampere-hour battery is installed.

The car also makes its own steam and air. For the former the car has an 1,600-lb.-per-hour Vapor steam generator. Air is furnished by a small air compressor installed essentially for service purposes, but which is controlled by a standard locomotive unloader and doubles for educational purposes in studying the parts and the governor operation.

Although the car is well equipped to furnish its own air, steam and electricity, the plans are to use yard facilities where they are available.

The basic car heating system was unchanged from that on the combination car. It works either on outside steam or generates its own. The evaporator has electric heating units which are sufficient to keep the car com-



The front half of the car, showing the cutaway engine section, the steam generator and the folding doors which close off the boiler room from the remainder of the car

fortable at temperatures down to about 25 deg. The power for these units can come either from outside current or from the under-car power plant.

Manually Controlled Aid Conditioning

Manual air conditioning control was decided upon for greater flexibility and because the diesel instructor aboard at all times has the knowledge to operate it properly. Conditions can be met as they arise. The system is arranged for heating with or without the fan on. Thus the heat can be on without the fan when deadheading, eliminating having to run the under-car power plant.

The steam generator room is not air conditioned and it does not have any floor heating ducts. This is one reason why this room is partitioned off from the rest of the car, the other being to keep smoke and noise out of the classroom section.

Floor heating ducts are installed only in the rear, or vestibule half of the car, but the overhead heating ducts extend the length of the car. The absence of the floor ducts provides flush walls for the mounting of heavy equipment. The lack of floor heat in the front of the car is not expected to be disadvantageous as people in this area are on their feet and moving about, not requiring as warm a temperature as those sitting in the rear.

The water cooler, refrigerator, hot plate and registry desk for all practical purposes occupy a single space. The top of the water cooler serves as the registry desk. Removing this top exposes a 2-kw. hot plate for cooking. Underneath the water cooler is a 1½-cu. ft. refrigerator space, the refrigerator unit of which also cools the drinking water. The refrigerator and the cooking facilities were included in the car because it will be tied up at roundhouses and other locations not readily accessible to restaurants, and for times when the car is moving in freight trains.

The car water system has a 300-gal. overhead tank. The heating water tank has a capacity of 500 gal. and the fuel oil tank a capacity of 250 gal. Standard boiler water and fuel tank gages are installed for both instruction and use. The wash basin, shower and toilet are of the type used in work cars.

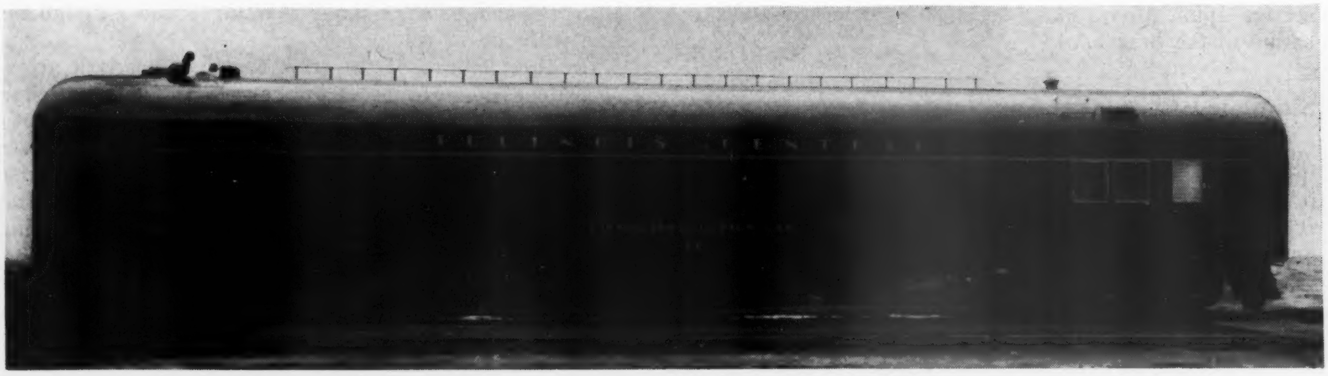
The fuel pump installed primarily for instructional purposes can be used for handling fuel. A tee is put in the pump suction line and one in the discharge line to permit taking, transferring or discharging fuel.

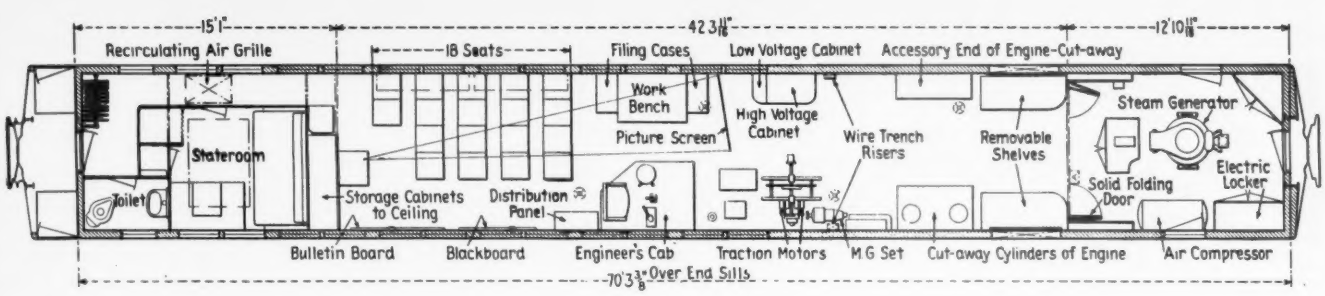
The underneath construction and arrangement of the car follows conventional lines. Protection from freezing is attained by a steam line that taps off the train line to the crossover pipe (with which it is lagged) between the two water tanks thence through the fuel tank to the power plant box, to keep the engine warm for starting, and terminates at a trap. The steam generator has the usual protection against freezing as on locomotives.

The car carries a complete set of locomotive brake equipment for instructional purposes, but which is used also for car braking by setting the equipment up as a dead locomotive.

All Wiring in Troughs

All wiring has been placed in troughs for easy maintenance and for easy adding or changing of circuits in the future. There are two troughs at head level. On one side the trough runs the length of the car; on the other it extends through the rear half only. The two troughs are tied together by a crossover under the floor in the





The diesel instruction car and its floor plan

middle of the car and are joined to the crossover by a riser on each side. The crossover further connects to two lengthwise troughs built into the floor on each side of the center sill and running from truck to truck.

The head level troughs are channels 4 in. deep and 6 in. wide made of 16-gage steel. The tops are hinged for easy access. The hinged tops are not continuous, but any point along the trough can be easily reached. The use of these head-level troughs not only permitted easy access to the wiring, but they eliminated the Z-section closing or sealing strip between the ceiling and the side walls. This construction also gives an opening down through the walls.

The side troughs, or risers, are channels 4 in. by 8 in. and lead to trap doors in the floor which give access to these risers and to the floor troughs. Wires can be fishtailed through either of these sets of risers through these openings. The floor troughs fit the furring space on the underframe and eliminate all under-car conduit.

Tricks to Simulate Actual Operation

Wherever possible, actual locomotive equipment was installed, such as complete engine control, cab control and electrical equipment. Where various practical considerations precluded the installation of the actual locomotive equipment, models were used which simulate as close as possible the true performance of such actual equipment, and which will be used for teaching operation.

For example, in place of installing a regular diesel engine, a scrap tie tamper motor is used. This motor is controlled by the regular throttle equipment arranged to change the speed of this representative engine in the same way that the throttle controls the locomotive diesel engine. A switch was built and attached to the throttle operator which, through field control of the tie tamper motor, changes the speed of the representative diesel engine exactly as the throttle does on a locomotive. This arrangement gives all locomotive engine features, including shutdown, isolation switch, etc.

Attached to the motor is an oil pump which uses fuel oil as a working fluid. This discharges through a 30-lb. feed valve on the pump to simulate main bearing oil pressure on the gage and on the pressure switch as on a locomotive. An orifice is also incorporated in the pump discharge to represent piston cooling oil pressure, which varies with speed as on an actual engine.

This motor representing a diesel engine drives a small generator with the characteristics similar to a locomotive main generator. Two field contactors are included in the circuit as on a main generator, each partially building up the field with both having to be in to attain full field. The output of this generator to the high-voltage cabinet (an actual locomotive cabinet and wiring) is scaled down to 64 volts from 600.

The output of the high-voltage cabinet is fed to two simulated traction motors (1/6-hp. scrap kitchen exhaust fan motors). These are small series-commutator motors with the same characteristic curve as a locomotive traction motor. The two "traction motors" are belt connected to a steel disc 1/2 in. by 36 in. which represents main driving wheels. The disc is made large and heavy to give inertia characteristics comparable to a 7-car lightweight train. This layout also incorporates a 14-in. pulley on the same shaft on which two full-floating clasp brakes operate to bring the disc to a stop. The clasp brakes are operated by a model brake cylinder 1 3/4 in. in diameter. This brake cylinder is connected to the air brake line and is controlled by regular locomotive brake equipment.

This overall arrangement gives acceleration and deceleration characteristics comparable to actual train operation, but on a scaled-down time interval. It requires two minutes to accelerate the mock train to 60 m.p.h., 20 seconds to stop it from this speed with a

service application and 12 seconds by emergency application of the brakes.

Simulated Protective Equipment

The overspeed trip lever can be actuated by the instructor through a concealed solenoid. A microswitch on the overspeed trip linkage shuts down the motor representing the diesel engine, and it cannot be started until the overspeed trip is reset.

Hot engine alarm operation is simulated by an insulated steel box in which is placed a standard engine radiator thermometer, a standard hot engine alarm switch and a light bulb. When the instructor lights the bulb, the temperature within the box rises and the hot engine alarm goes off.

The control panel is equipped to blow fuses by putting shorts in various circuits by trip switches. On 30-amp. fuses for example, a 1.2 ohm resistance is put in parallel with the load, causing some 60 amp. to flow through the fuse with the 72-volt power.

Another feature of the trick switch panel is a group of switches in portions of the control circuit which stop the automatic transition. The transition sequence can be gone through a single step at a time for the first six steps, or until the functions begin to reverse. The principal purpose of this layout is not to trip up the student operator but to show what happens in each step by taking the sequence slowly.

Another trick circuit makes the starting contactors stick. In doing so the contactors are held in the stuck position by a tickler resistance which causes the contactor to be held in the stuck position but not so strongly that it cannot be puled out by hand, thus duplicating the usual condition of a stuck contactor on a locomotive.

Another trick switch trips the ground relay. The wheel slip relay has an adjustable rheostat in the circuit to make it work at any amperage.

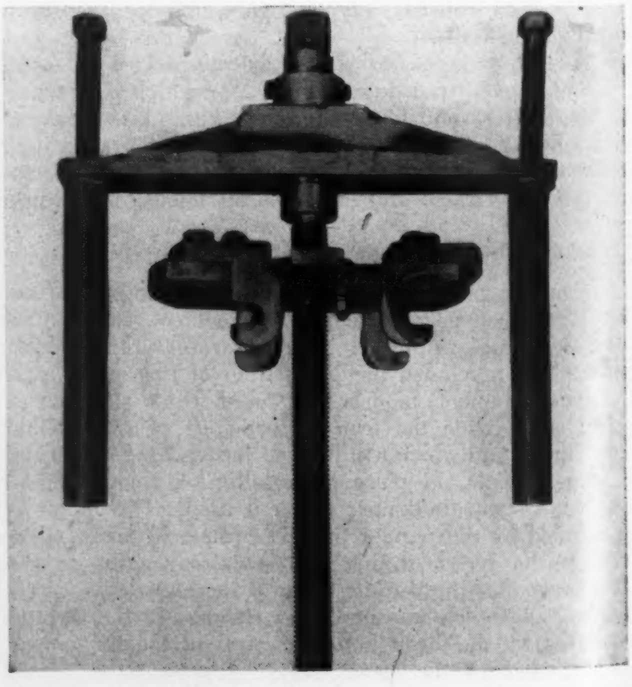
Portable Press Pulls Hyatt Bearings

A portable press is used at the Southern's Chatanooga, Tenn., shops for applying or removing Hyatt locomotive roller bearing outer races. The press requires about one minute for either operation, with a total overall time of about two minutes including all setup work.

The two main bolts of the jig are inserted into the bearing face bolt holes. Two lugs slide out on a jacking plate until the outside edges are even for removing the race. In this position the lugs engage the inside retainer ring of the bearings at the inside edge of the race. Turning with an air motor pulls the race out. To press the outer race in, the lugs are slid all the way out, at which position the jacking plate overlaps the lug by a half inch and engages the outer race.

The shaft is 1¼ in. in diameter with 7 double-pitch threads per inch. The jacking plate is ⅝ in. thick and has a brass insert ½ in. thick and 3 in. in diameter which is threaded and bolts on the jacking plate. The brass has a collar to fit into the plate and is held by four ⅜-in. bolts.

The jack screw has an overall length of 28 in. with 21 in. of thread. The guide for the holding bolt is made of 1 in. pipe and is 11 in. long. The brass collar in the head was graphited during assembly and requires no further lubrication.



Arrangement for pressing in the outer race

Three-meter spectrograph in operation in the chemical laboratory of the American Locomotive Company at Schenectady

How Spectrographic Analysis Controls Diesel Engine Maintenance

By *H. R. Sennstrom,*
Research and Testing Engineer,
American Locomotive Company

A NUMBER OF publications in recent years have described the excellent results obtained through spectroscopic analysis of diesel engine lubricating oils in controlling diesel engine maintenance. Outstanding work has been done by Ray McBrian of the Denver & Rio Grande Western; R. W. Seniff, of the Baltimore and Ohio; L. S. Crane of the Southern, C. C. Mugford of the Southern Pacific, and other railway test department personnel. Avoidance of serious engine failures, longer life of component parts, and more economical locomotive operation have resulted from the work of these investigators in a new application of this scientific tool.

The American Locomotive Company is currently collaborating with 18 railroad companies in extending this new technique in a broad-scale evaluation program. Although only a progress report is possible at the present time, the ultimate results of the program appear most promising. That there is a definite place for the spectrograph in the maintenance of diesel locomotives is a justifiable conclusion on the basis of experience gained thus far.

The Evaluation Problem

The over-all evaluation program was divided into two main phases. First it was necessary to select suitable laboratory equipment, develop standard methods of sampling, handling, and analyzing diesel engine crankcase lubricating oils, and establish base lines to make possible the interpretation of the analytical data in the form

of mechanical recommendations. The second part of the problem involved expanding acquired knowledge into the railroad field on a broad, clinical scale and correlating interpreted indications based on laboratory analysis with the actual mechanical conditions found on examination of engines. The primary phase is now completed and the secondary portion of the problem is approaching completion.

Laboratory Equipment and Technique

The equipment chosen by the American Locomotive Company included a three-meter grating type spectrograph, a multiple arc source, a densitometer, and a variety of other equipment necessary to handle the task economically. This equipment is illustrated and identified in the accompanying photographs.

A review of various methods of taking lubricating oil samples from the crankcase and of analyzing these samples for certain elements resulted in a relatively simple procedure. Experience has dictated that lubricating oil samples should be removed directly from the crankcase while the engine is idling and soon after a road run. It is desirable to sample the crankcase every 15 days.

A measured sample of the lubricating oil is burned and ashed. After an internal standard (lithium carbonate) has been thoroughly mixed with the ash, a small amount of the mixture is placed on an electrode and subjected to arcing in the spectograph. The resulting photographich plate contains the spectrum of that particular ash sample. After developing, the plate is placed in the densitometer for quantitative evaluation. This procedure results in any analytical report giving the desired elements in terms of parts per million.

For control purposes on the Alco 9-in. x 10½-in. Model 244 engine, six chemical elements were chosen. Silicon was selected because it is representative of typical air-borne dirt which might enter the engine through improperly functioning air filters. Iron is an indicator for ring- or gear-wear products. Chromium represents liner wear or water leaks, since water treatment fundamentally involves a chromate. Aluminum is representative of the aluminum piston and lead and copper represent or indicate crankshaft bearing conditions.

Laboratory Engine Tests

An extensive series of full-scale laboratory engine tests were run to determine fundamental base lines which would aid in interpreting the analytical data obtained on the spectrograph. First, a standard engine was run for an extended period under as nearly ideal conditions as possible to establish fundamental wear-rate data. Frequent lubricating oil samples were removed from the crankcase and subjected to spectrographic analysis. In this way normal levels of each of the six elements were established, which represented good engine-component performance.

The engine was then subjected to certain types of maltreatment, including the introduction of dirt into the engine air intake, and the deliberate introduction of treated water into the crankcase.

As a result of these tests, approximate limits were established for each of the elements, representing the transition points between good engine performance and faulty engine performance. To check the laboratory work, a limited number of lubricating oil samples were obtained from engines on various railroads and subjected to similar spectrographic analysis. The results were found to parallel one another.

Having thus established the methods and techniques for sampling the crankcase lubricating oil and analyzing it for the six indicator elements in the spectograph in a simple and economical way, the first phase of the project was considered complete.

Collecting and Interpreting Field Data

It was then necessary to open the second phase of the problem, in which an effort is now being made to establish clinical evidence as to the degree of correct interpretation of spectrographic analyses that is possible under actual railway operating conditions.

Among the 18 railroads collaborating with the American Locomotive Company on this survey there are both large and small railroads running in all parts of the United States, with locomotives operating in freight, passenger, and road-switching assignments. The work was started approximately September 1, 1951, and has been increasing in scope since that date. About 4,000 samples have been obtained from over 800 engines in various types of service. Some samples have been taken on a monthly basis, but most samples have been taken every two weeks, while a few engines have been followed very closely, involving sampling as frequently as every four or five days.

The lubricating oil samples from most of the 18 railroads have been sent direct to Schenectady, although some railroads have had the samples ashed in their own laboratories, forwarding the ash in small vials to the Alco laboratory at Schenectady. A production-line set-up has been installed in this laboratory so that all samples are handled and reported on within 36 hours after their receipt.

Reports presenting the spectrographic analysis of the six indicator elements in terms of parts per million, together with an interpretation of these values, are issued daily directly to the mechanical personnel and the engineer in charge of tests for the involved railroads. If the interpretation indicates that a specific examination or type of preventive maintenance is desirable, the report so states.

Typical Test Results

Some of the information obtained to date is worthy of note. During the establishment of fundamental base values for the indicator elements, a standard 12-cylinder, 9-in. x 10½-in. Model 244 engine was operated on an 80 per cent full-load cycling schedule in the laboratory. Engine performance was excellent in every way, and there was no maltreatment of the engine during a 200-hour run. Lubricating oil samples were taken at eight-hour intervals. It was noted that wear rates were rather high for the first 24 hours, representing break-in conditions. The wear rates rapidly leveled off to the following approximate values: lead, 5 ppm; silicon, 3 ppm; iron, 8 ppm; chromium, 4 ppm; aluminum, 2 ppm; copper, 3 ppm.

The above values represent the operation of the diesel engine under ideal laboratory conditions. Samples taken from many properly functioning engines in locomotives indicate that the base lines under actual operating conditions are slightly different. The base values found in these cases were as follows: lead, 10ppm; silicon, 6 ppm; iron, 20 ppm; chromium, 5 ppm; aluminum, 3 ppm; copper, 4 ppm.

This difference is undoubtedly due to the more dusty atmosphere in which a locomotive must operate, which results in slightly higher rates of wear. It has been established that so long as wear particles, determined by spectrographic lubricating oil analysis, are in this general range, the engine is functioning properly.

Determination of relative density of spectrum lines using the densitometer.

Effect of Dirt on Engine Performance

The above survey has indicated that dirt introduced through the air stream into a diesel engine can be extremely serious. When dirt was deliberately introduced into an engine during laboratory testing, very alarming results were noted. One-half pound of standardized Arizona road dust of 0 to 80 micron particle size was added to the inlet manifold over a two-hour period. All wear rates immediately rose to high values. It was noted, however, that the silicon, which represents the dirt itself, was quickly filtered out of the lubricating oil. Iron, chromium, and aluminum continued to rise for a considerable time after the dirt had been injected, indicating that ring, piston, and liner damage continued in spite of the elimination of the dirt.

It is surmised that the dirt itself damaged the upper rings. As the upper rings continued to operate in the damaged condition, particles worn from their surface worked downward through the assembly and caused damage to the lower rings and pistons. Some 50 hours after the dirt had been introduced the lead value started to rise, indicating scratching of the lead-in overlay of the bearing due to wear particles. Three hundred hours after the dirt had been applied it was necessary to stop the engine and to replace the piston rings because of the extreme damage done to them.

The above test results have been borne out in actual field service. In some cases improper oiling of air filters has resulted in extreme damage to cylinder parts. In spite of lubricating oil change-out and even flushing of the crankcase, the damage could not be stopped. It appears that if an engine is subjected to any large quantity of air-borne dirt, piston ring replacement cannot be avoided.

Bearing Failure

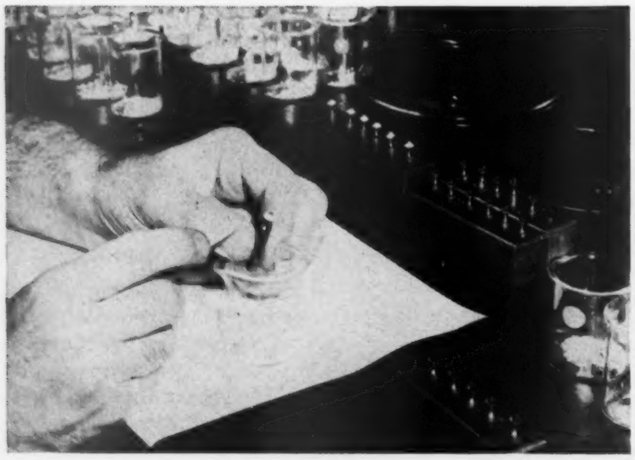
The spectrograph has established itself as a prognosticator of bearing difficulty. Table 1 indicates the detection of incipient bearing failure by spectrograph lubricating oil analysis.

On the basis of the analysis of the November 25th sample, the locomotive was removed from service on December 9 for a bearing inspection, at which time the last noted sample was taken. It was found that one of the main bearings had wiped through the overlay and into the intermediate copper-lead layer. It is important to note that the lubricating oil sample taken 1½ months prior to the removal of the locomotive from service definitely indicated the incipient bearing failure.

Following a bearing failure the lubricating oil is naturally contaminated with particles from the failed bearing. If the lubricating oil is not changed at the time of

Table 1—SPECTROGRAPHIC DETECTION OF INCIPIENT BEARING FAILURE

Date of Sample	9/2	9/13	9/28	10/11	10/18	10/23	11/11	11/25	12/9
Pentane Insoluble, per cent	.01	.01			.05	.01	.01	.01	.17
Ash, per cent		.50	.52	.46	.46	.49	.44	.41	.44
Lead, ppm	6	4	5	6	7	18	30	44	99
Silicon, ppm	4	8	3	5	4	1	1	2	1
Iron, ppm	12	19	16	12	14	17	14	21	19
Chromium, ppm	1	1	1	1	1	1	1	1	1
Aluminum, ppm	1	2	2	1	2	1	2	1	1
Copper, ppm	5	12	9	7	6	6	6	7	13



Lubricating-oil ash being applied to the platform type electrodes prior to insertion into the spectroscope for burning

Table 2—CONTAMINATION OF LUBRICATING OIL FOLLOWING BEARING DIFFICULTY

Date of Sample	9/14	9/19	9/28	10/11	10/24	11/11	11/30	12/9	12/15	12/25
Pentane Insoluble, per cent	.01	.03		.12	.12	.01	.01	.02	.03	.02
Ash, per cent	.44	.40	.37	.38	.33	.40	.54	.47	.46	.52
Lead, ppm	3	2	5	9	26	48	36	17	1	2
Silicon, ppm	5	7	5	28	1	1	3	2	3	2
Iron, ppm	13	14	11	11	18	17	6	4	3	6
Chromium, ppm	1	1	1	1	1	3	2	1	1	2
Aluminum, ppm	1	1	1	1	1	1	2	1	1	2
Copper, ppm	2	3	1	2	2	13	4	3	1	2

bearing inspection, this contamination must be taken into consideration if false indications are to be avoided. Table 2 exemplifies such a case.

In this case the locomotive was removed from service on November 25 and a main bearing was replaced. This bearing, incidentally, had worn through the overlay and down into the copper-lead intermediate layer. Note the gradual reduction in the quantity of lead shown in the samples taken November 30 and December 9. The filters were changed at the time of the bearing replacement and again following the sample of December 9.

Water Leaks and Other Difficulties

Water leaks are identified by a rise in the chromium value. As chromate-treated water enters the crankcase, the water generally is dissipated, but the chromium in the chromate treatment remains in the lubricating oil. In engines equipped with iron liners it can be assumed that all chromium results from water treatment.

However, in the Alco engine utilizing chromium plated liners, the identification of the cause of chromium is slightly more involved. Normally, when a liner is in difficulty the rings also are wearing rapidly. Therefore one can expect a combination of high chromium and high iron to represent ring and liner difficulty, whereas high chromium alone would be indicative of a water leak.

By this method the correlation between the spectrographic analysis and actual water leaks discovered has been extremely good, and even very small leaks can be detected. Experience indicates that chromium values under 50 ppm are incidental water leaks, but values above 50 ppm indicate relatively serious water leakage into the crankcase.

During this period of generalized testing, some unusual results have been obtained. In one instance a seriously misapplied connecting-rod bearing was detected before serious damage occurred. In this case the rod bearing had been placed in backwards, crushing the connecting-rod bearing keeper. The spectrographic analysis indicated severe bearing trouble, which upon inspection proved to be due to the misapplied bearing. In another case a standard-size main bearing had inadvertently been applied to an undersized journal. This caused virtual line contact between the shaft and the bearing, resulting in an extremely rapid increase in the copper and lead values, again denoting an undesirable bearing condition. A broken main bearing cap was similarly detected.

It is understandable that the interpretation and recommendations, particularly at the outset of this undertaking, were not always correct. However, in the past few months excellent correlation has been obtained on such specific instances as high rates of piston and ring wear due to air-borne dirt, excessive water leaks due to misapplied gaskets, cracked cylinder heads, etc., as well as bearing difficulties. In a number of cases serious engine failures have been averted through recognition of poor component-part performance before damage occurred.

Summary and Conclusions

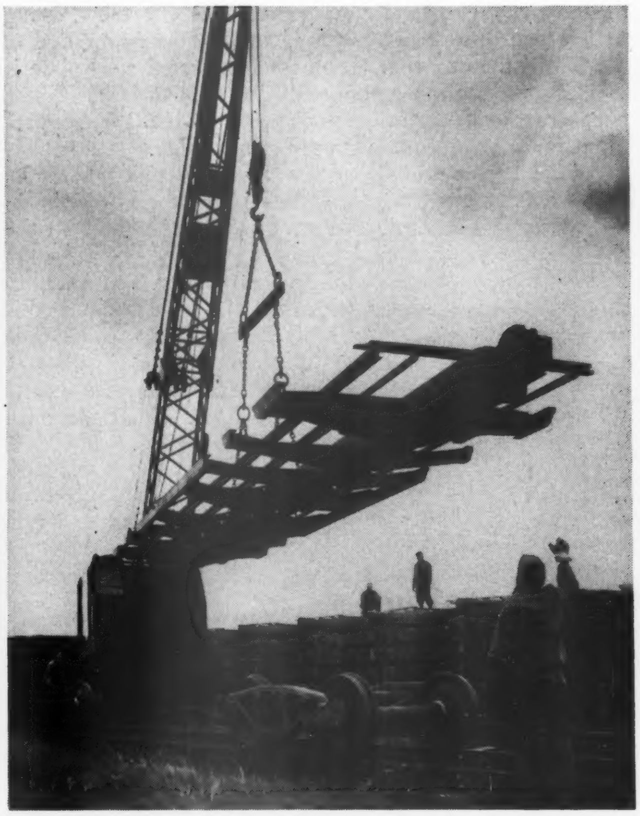
The investigation thus far has proved that the spectrographic analysis of lubricating oil can be used to avert serious engine breakdowns. There is also excellent clinical information to indicate that improvement in diesel engine life can be obtained, particularly with reference to the proper maintenance of air filters so as to avoid undue wear rates due to dirt entering the engine. Lubricating oil quality effect can be noted in so far as relative rates of wear are concerned.

But basically the spectrograph offers a still further potential in its application to railroad locomotive maintenance. At present, diesel engines in railroad locomotives are subjected to periodic maintenance programs which are generally based on mileage or time intervals established rather arbitrarily. Frequently these intervals are rather conservative and engines are overhauled unnecessarily. With the spectrograph's ability to indicate general engine conditions the maintenance intervals might be adjusted to the needs of each individual diesel engine.

It certainly would be desirable to avoid overhauling any diesel engine unless there is ample justification for the overhaul. Within the limits of shop facilities the spectrograph might lead to more rational engine maintenance scheduling which takes into account the characteristics and the condition of each individual diesel engine rather than the characteristics or conditions implied by experience with the poorest performance. Much further study is being made along these lines, and the present investigation has not developed far enough to report with any great degree of conclusiveness in this respect. Indications, however, imply success in this direction also.

A word concerning cost might be appropriate at this time. In general the complete research-type spectrograph available today, together with all necessary components for its operation, involves an investment of from $25,000 to $35,000. The operation of the equipment, together with all supplies and necessary personnel, places the unit cost of each sample analyzed in the range of $5 to $10. It can be readily seen that such expenditure can be amply justified, even if a modest number of engine failures can thereby be avoided.

Assembling steel roofs for new box cars at St. Cloud shops



Underframes, fabricated at Superior, being applied to trucks at St. Cloud.

Box Cars Built at St. Cloud Shops

THE Great Northern has just completed construction of another order for 1,000 box cars at the St. Cloud, Minn., shops, quite similar to those built in 1949 except for a few details of design. The present car has 50 tons nominal capacity and a light weight of 41,800 lb., giving a load limit of 127,200 lb. The inside dimensions are 40 ft. 6 in. long by 9 ft. 2 in. wide by 10 ft. 2 in. high; cubic capacity 3,760 cu. ft.

The cars were built in two assembly lines, underframes being fabricated at the Great Northern shops at Superior, Wis., during last summer. Construction of the cars was begun in October and by early November, St. Cloud shops was on full production of 20 cars a day, a pace which was kept up until January 20 when the last car was completed. Approximately 200 men were employed on the two assembly lines and a small additional force on material fabrication and associated work adjacent to the assembly lines.

In the cars built in 1949, Standard perforated door plates were applied in the doorway only, the rest of the floor being 1¾-in. wood decking from end to end. In the more recent box cars, the Great Northern installed: (a) perforated steel plates from bolster to bolster in 800 of the cars; (b) Great Lakes nailable steel floors in 100 of the cars; and (c) Armco flooring with metal channels and wood inserts in 100 cars.

A feature of the assembly operation was the application of decking to the Standard perforated steel plates in panels before being installed in the cars, thus simplifying and speeding up the work.

Each panel consists of five pieces of 1¾-in. by 5¼-in. selected decking. These five pieces are placed upon and

securely clamped to a jig. Here holes for the decking bolts are drilled and a heavy coat of sealer is applied to the top of the decking. Then the perforated steel plate is applied over the five pieces and secured with bolts. These panels are made up in advance so that when the car program is on an adequate supply is available.

At the two stations on each assembly line where the decking is applied to cars, these panels are placed in the car from bolster to bolster. From the bolster to the end of the car regular $1\frac{3}{4}$-in. decking only is applied. The decking is bolted and securely wedged from both ends so it is well sealed to prevent leakage. The panels are secured to the car by bolts fastened to the side sills and also by bolts and floor clips to the center sill, also by bolts and clips to the floor stringers. Fourteen panels are used per car from bolster to bolster. The panels are brought into the car manually for installation.

Another different shop practice was the application of Flintcote to the under surfaces of roofs before application to car bodies in the 1949 operation, whereas this material is now sprayed on as the final operation before the cars are ready for service. Assembly is complete, exterior painting done, lining sprayed, etc., before insulating material is sprayed on the undersides of the roofs of the otherwise finished cars.

The Great Northern is particularly proud of its trademark, the mountain goat, carefully stenciled in light-reflecting Scotchlite on the car sides. Also stenciled on both sides of the cars with the same material are the railroad name, car number and a horizontal row of circular targets near the bottom. The latter effectively show the presence of moving cars at grade crossings during the night, or at any other time when visibility is poor.

Straightening Stainless Steel Fluting

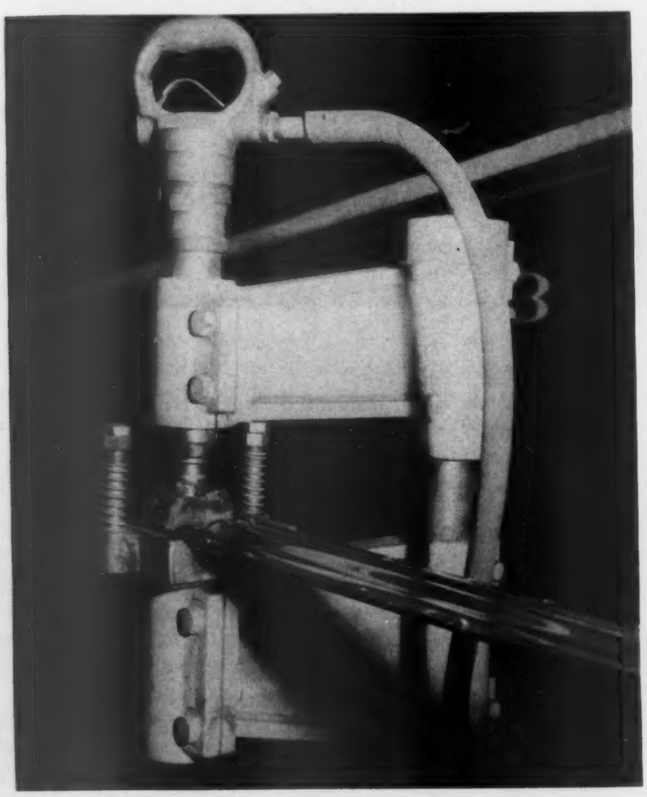
The decorative stainless steel fluting used on passenger cars is reconditioned to look like new with a press and a roller at the Spartanburg, S. C., shops of the Southern. The fluting is cleaned by hand, using alcohol and steel wool. It is run through a press with form dies to knock out the kinks with an air hammer.

The press, in knocking out the kinks, also spreads the moulding, and the fluting thus requires reshaping. This is done by running it through three pair of form rolls, using No. 20 oil for lubrication.

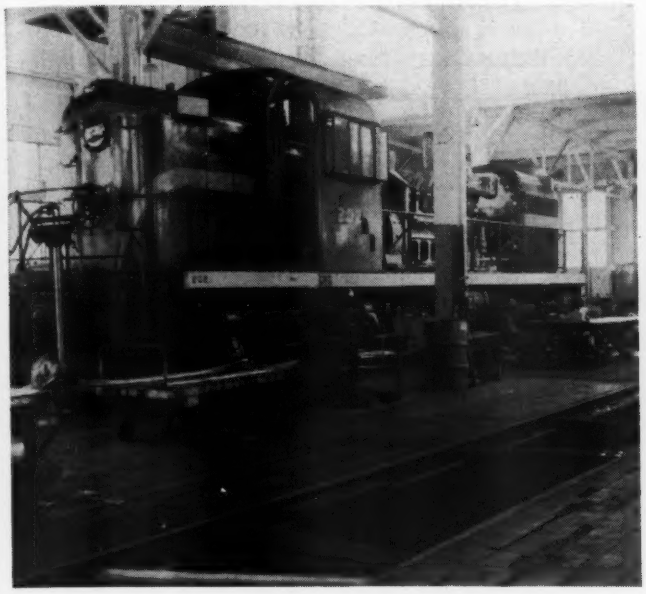
The rollers are driven at 30 r.p.m. by a 3-hp. motor through reduction gearing, and may be revolved in either direction. The rollers are 8 in. in diameter and mounted on shafts 3 in. in diameter and $1\frac{3}{4}$ in. long at a center-to-center distance of 18 in. Bearings for the roller shafts are holes cut in 5-in. square plates on the frame of the assembly.

A guide made of $\frac{1}{8}$-in. plates is incorporated between the last two pair of rollers to squeeze the molding back to its original dimension. Continuous lubrication is provided by six pet cocks which oil the roller faces. Brushes are used at each end of the operation to wipe the dirt off coming in and to wipe the oil off going out.

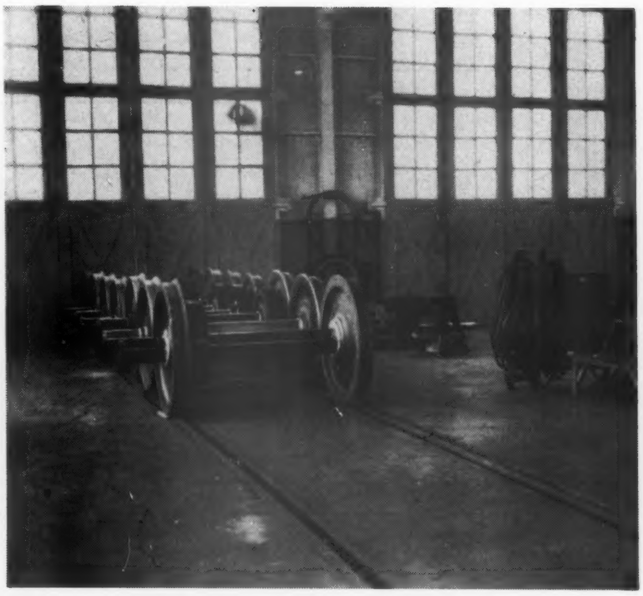
The press which knocks out the kinks is foot pedal operated and built up from $\frac{3}{4}$-in. plate. The main column was constructed from an old axle with the I-beam-section press supports welded in place.



Air-operated, foot-pedal-controlled press (left). As the moulding spreads as the press knocks out the kinks (above), it is reshaped by running it through three pairs of form rolls

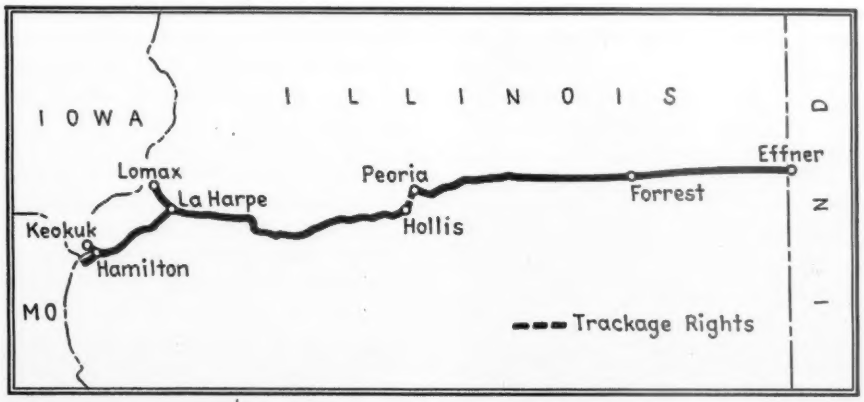


An Alco road switcher undergoing engine reconditioning work



Storage area for wheel sets, welding generators, head fixtures, etc.

Diesel Maintenance on the Toledo, Peoria & Western

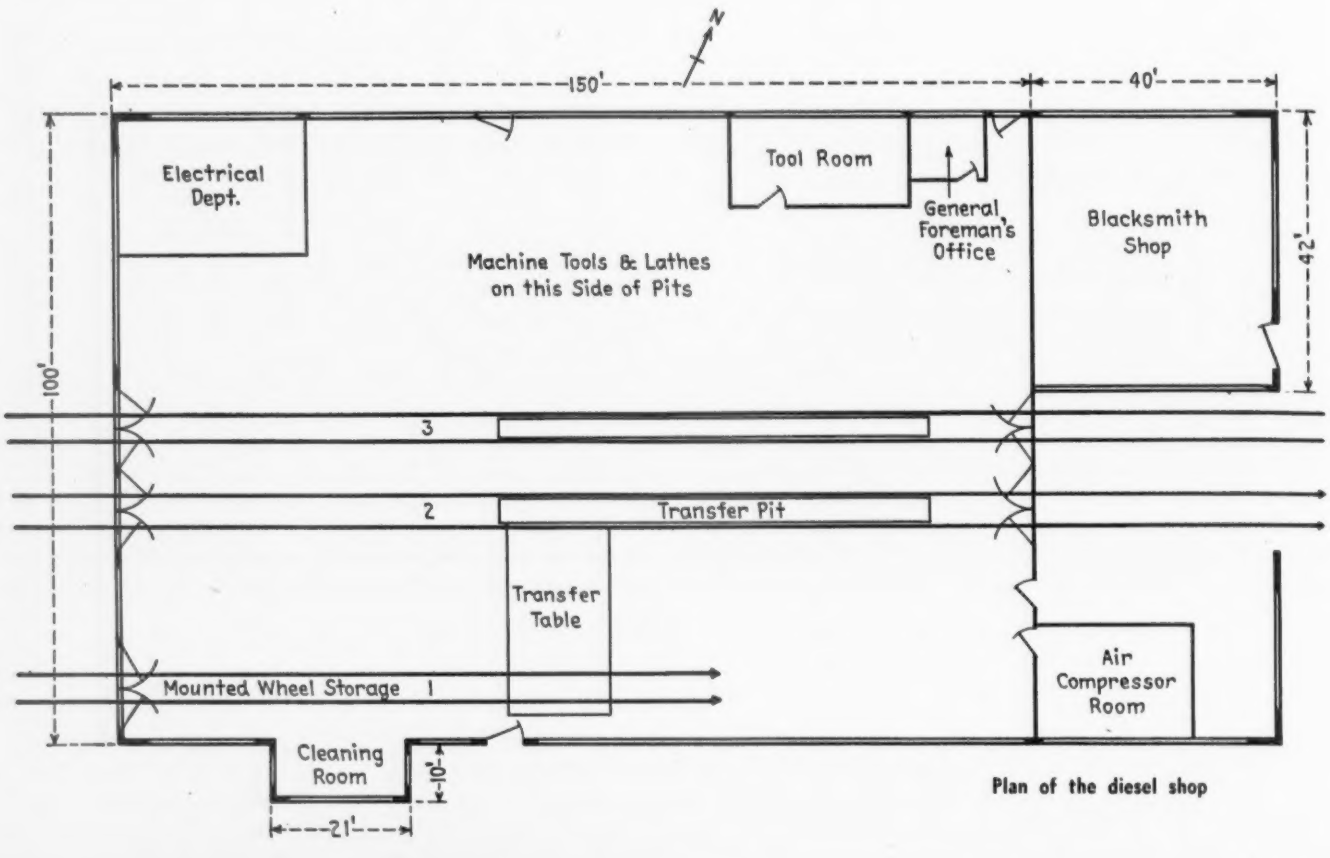


THE problem of coordinating the operation and maintenance of locomotives on a fully dieselized small road is by nature somewhat complex because with relatively few units protection power cannot be furnished on an economic basis. The T.P.&W. has devised a solution to this problem which not only coordinates maintenance, but crew assignments as well, with an overall operation that emphasizes dependability and service to shippers.

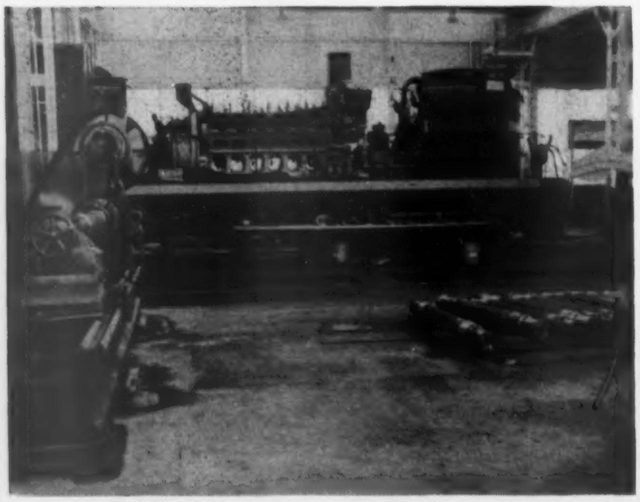
The total motive power inventory at the time this was written comprised 13 units to cover the territory shown on the accompanying map. All maintenance, and all but the most minor servicing, is done at Peoria, Ill. near the mid point of the line. The road normally operates two time freights daily out of Peoria in each direction, a local each day in each direction between Peoria and Effner, Ind., a daily local making a round trip daily between Peoria and Hamilton, Ill. which is just across the river from Koekuk, Iowa on the east side, and a shuttle run between La Harpe and Hamilton. Distances out of Peoria are: 111 miles to Effner; 113 miles to Hamilton; 95 miles to Lomas; and 86 miles to La Harpe.

The 13 motive power units are divided as follows: two General Motors 1,500-hp. road freight units, eight Alco 1,500-hp. road switchers, and three Lima-Hamilton 1,200-hp. switchers. All of the latter are stationed at Peoria.

The two G.M. units leave Peoria at 1:00 p.m. on train 121 to Lomax, returning to La Harpe with the same crew on train 120. This crew ties up at La Harpe for their 8-hr.



Plan of the diesel shop


Most parts repair work is done along each side of the locomotive

rest. A crew coming up from Hamilton on a local run with one of the Alco road switchers takes over the G.M. units, combines the Hamilton cars with train 120 from Lomax, and proceeds to Peoria where arrival is about midnight. After a 2-hr. servicing period, the G.M. units proceed to Effner and return on trains 20 and 21 after getting a new crew at Peoria and another at Effner. Arrival at Peoria of 21 is 11 a.m., completing the daily 412-mile cycle of these two road units.

The second of the two daily time freights is handled by two of the Alco road switchers and leaves Peoria as Train No. 123 at 9:30 p.m. The two units take the train to La Harpe, where one unit is taken off to make the local run to Hamilton and back. At the same time the single unit that was assigned to this La Harpe-Hamilton shuttle service on the previous day is coupled to the other Alco unit that brought Train 123 from Peoria. By making this change and rotating the shuttle unit assignment among the three road switchers, all servicing and maintenance except the daily inspection can be done at Peoria, and this is readily handled by the maintenance man stationed at La Harpe to inspect all units passing through.

The crew that brought the original two Alco's into La Harpe takes over the shuttle unit to Hamilton. The crew from train 121, which arrived about nine hours earlier on


The transfer table is moved by the traveling crane through a fixed sheave just beyond the outer rail of each of the two tracks served by the table. The table moves on six roller-bearing wheels and is secured in place by sliding bars.

the two G.M. units, take over the new Alco two-unit combination. They operate train 123 from La Harpe to Lomax and back to Peoria, where arrival is about 10 a.m. The units depart from Peoria for 4 p.m. arrival with No. 22 at Effner, leaving Effner on No. 23 to return to Peoria at 8 p.m., using a new crew for each of these two one-way trips. This completes the daily cycle of three of the Alco's and covers 469 train-miles, including the 57-mile round trip of the shuttle unit between La Harpe and Hamilton.

Two more Alco's are assigned to night local trains Nos. 24 and 25 between Peoria and Effner. One unit is assigned to each train, but two units are required to handle the assignment as the eastbound and westbound trains pass each other about midway en route. No. 24 leaves Peoria at 8 p.m. and arrives Effner at 6 a.m. No. 25 departs Effner 7 p.m., arrives Peoria 5 a.m.

Formerly both of these trains were covered by one unit which made the round trip daily but necessitated operating one of the trains during the day. The schedule was changed to improve service to the shippers by giving a move in both directions every day. The night schedule permits the cars to be loaded during the day and the loads picked up for movement the same night.

Another pair of the road switchers is used for extras either east or westbound. When used westbound the units do not split at La Harpe as only one crew is available. The remaining road switcher does local work west as Train 103-104.

The General Motors road units and the Alco road switchers exchange assignments on the time freights on occasion, usually when heavy work is required on the G. M. units. This is necessary because of the short time available for maintenance at Peoria. When this interchange takes place, some modification must of course be made to remaining assignments to furnish the two units for the time freight, and this is determined individually for each case. The principal change that must be made regularly is the elimination of the changeout of the shuttle unit at La Harpe.

All servicing and maintenance is done at Peoria in the center of the road. A portion of the existing roundhouse is used for servicing work up to and including monthly inspection. No platforms were installed for this work, nor were any other changes made in the house. The 100-ft. turntable is adequate for turning any type of double-unit locomotive on the T. P. & W.

The shop building is used for quarterly inspection work and heavy repairs as required. The basic structure and layout are generally unchanged from the days when it was used to maintain steam power. Today, the building in addition to being used for diesel locomotive repairs, also serves as a job shop for all other departments of the railroad, maintains miscellaneous equipment for the engineering department, and does heavy metal fabricating work for the bridge and building department.

The shop building is 100 ft. wide by 150 ft. deep and made of corrugated steel. It is served by three tracks—two through tracks near the center of the building and a stub track near the south side which extends a little over half way through the building. Roughly speaking, the eastern two-thirds of the building is devoted to diesel locomotive work, the western third to maintenance-of-way machinery repairs, except for a section along the south edge used for diesel parts cleaning and mounted wheel storage.

One of the principal changes made in the shop in converting it to diesel repairs was the installation of a transfer table and the abandonment of the drop pit. This occurred during the transition period when both steam and diesel locomotives were being maintained. The drop pit was between Tracks 2 and 3; the transfer table was installed between Tracks 1 and 2.

The transfer table was installed for truck changeout because it was easier and cheaper than enlarging the drop pit. It was installed between Tracks 1 and 2, rather than between Tracks 2 and 3 where the drop pit was, so that there would be no interruption to work on Tracks 2 and 3 due to the installation procedure. It further fits in nicely with the use of Track 1 for storage of mounted wheel sets, the wheels being removed from the truck on Track 1 by lifting the truck with the traveling crane.

The transfer table was built by the shop forces. It is built up from heavy I-beam and channel sections and is of all-welded construction. The table moves back and forth between the two tracks on three rails supported on six roller bearing wheels. A fixed sheave is mounted just beyond each of the outer rails of the two tracks served by the table. Movement of the table is made by the traveling crane through these sheaves. A wire cable is hooked to the table, then through the sheave wheel on the side toward which the table is to be moved, and finally to the hook of the traveling crane hoist. Raising the hoist thus moves the table.

The traveling crane which moves the transfer table spans the center 50 ft. of the shop from the north to the south wall and has a 10-ton hoist. It is supplemented by jib cranes at strategic locations throughout the shop.

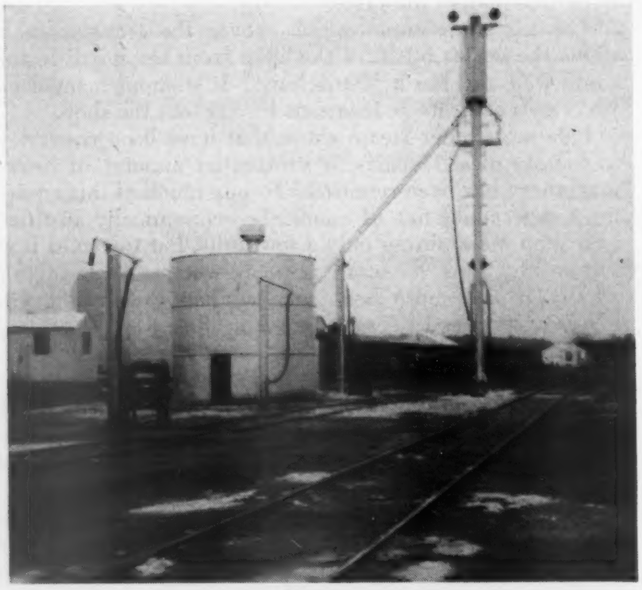
Like most other steam shops that have been converted to handle diesel repairs, a substantial amount of heavy machinery has been retained. To buy much of this equipment new could not of course be economically justified in a shop maintaining only a few units, but to retain it at the cost of only its scrap value is worthwhile. In this particular case, more machinery was kept than might normally be expected because the shop does a good deal of work for other departments. Among the machinery retained and the use to which it is put is the following:

1. 50-ton hydraulic press for straightening and bending plates, pressing out shafts and bushings, and for shop order work for other departments, principally bridge and building.
2. 42-in. boring mill to bore air compressor cylinders and to grind Alco cylinder head joints. The latter is done by affixing a grinder to the boring bars and checking with a dial indicator.
3. Radial drill press for miscellaneous boring, drilling and tapping.
4. 27-in. by 96-in. engine lathe for diesel axle work, refacing heads, and for liner and shop order work.
5. 32-in. shaper for making tools, jigs and fixtures.
6. Two medium sized engine lathes, one 12 in. by 72 in. and the other 14 in. by 72 in. for nuts, bolts, etc.
7. Turret lathe for studs, bushings and roughing out work.
8. An air hammer converted from a steam hammer in the blacksmith shop for miscellaneous work.
9. Punch and shears in the blacksmith shop, 5/8-in. capacity, for cutting plates and bar stock and punching holes.
10. Miscellaneous smaller machinery, such as a 9/16-in. drill press, power pipe vise, power pipe threader, new valve grinding machine, and such new hand tools as socket and open end wrench sets, hand torque wrench, impact wrenches, etc.

General Maintenance Procedures

Heavy repairs are made to locomotives after an average

The T. P. & W. diesel shop



Outdoor facilities can fuel and sand two units simultaneously

A separate bay, 10 ft. by 21 ft., constructed for all cleaning operations

of from 300,000 to 350,000 miles of service, which occurs after about three years on the switching locomotives and two years on the road and road switcher units.

Mechanical work done comprises overhauling of cylinder assemblies, main and connecting rod bushings, water pumps, fuel pumps, air compressors and fan drive assemblies, cleaning pistons and grinding valves and seats. Unit exchange is planned for engines requiring more extensive work, and for traction motors, turbo-chargers, governors, tachometer-generators and motor-alternators. Some small motors, such as fuel pump motors, are repaired at Peoria if armatures do not require rewinding. All but the heaviest maintenance is done on main generators, exciters and blower motors. This includes cleaning, dressing the commutator, and spraying with Glyptol. This work is also done to some extent on traction motors.

No oversize parts are used. When liners are worn over .025 in., they are chromed, or re-chromed as the case may be, back to standard. Lima-Hamilton and General Motors liners are currently honed; they are not at present chromed as are the Alco liners. Welding is used chiefly for body work; little reclamation is as yet done by this method.

Five different brands of high-detergent oil are used, with mixing of different brands prohibited. Change is made as a result of chemical test only; this chemical test is made by an outside laboratory twice a month. A daily blotter spot test is made.

Air filters, heads, liners and pistons are cleaned in a small bay constructed along the south wall. The room contains a cleaning solution tank, steam coil drier and an oiler. A jib crane with a 10-ft. radius and hand hoist handles the parts.

Outdoors are two 68,000-gal. fuel oil tanks and a fueling and sanding station that fuels and sands two units simultaneously with two 80-g.p.m. pumps and suitable sand hoses. Sand storage has a capacity of three cars; dry sand storage is $3\frac{1}{2}$ cu. yd. and is mounted on top of a 20-in. tube 40 ft. high. Sand is handled from wet storage to the drier by a conveyor, and is blown from the drier to the dry sand storage. Drying is by a steam coil drier with a capacity of 7 cu. yd. per day.

Changes in Interchange Rules*

By T. J. Boring†

Rule 23

New Section D—Added to provide for welding of high tensile Grade C steel castings such as couplers and yokes, truck side frames and bolsters, etc.

Rule 32

Section (10-L), Flood—A circular letter dated November 19, 1951 by the Secretary, A. A. R. Mech. Div., issued the following interpretation from the Arbitration Committee:

"On account of the unusual severity and extent of flood damage to a large number of freight cars that were partially or totally submerged during floods which occurred in the Midwest last summer, many questions have arisen regarding responsibility, settlements, etc. These questions were placed before the Arbitration Committee at the last meeting and the following interpretations were approved:

"'Section (10) (1) of Rule 32 and Paragraph (12) of Section (a) of Passenger Car Rule 8 include damage to any part of the car; C. O. T. & S. of air brakes together with the work to be performed as outlined in Section V of Supplement No. 1 of Instruction leaflet Number 2391 when brakes have been submerged; repacking of journal boxes and all other work performed as specified in the Lubrication Manual; rusted or pitted journals; cleaning inside and outside of car and parts thereof of silt, mud, grease, tars, acids, etc.; painting where necessary; renewal of sheathing, lining, flooring or ceiling, due to warped, split or contaminated condition; and including insulation which has been contaminated or otherwise damaged.'

"'If a car with flood damage concealed in ordinary inspection and without flood damage defect card attached is found to have been partly or totally submerged in flood, the 90-day limit for procuring joint inspection under Section (k) and Interpretation 3 of Rule 4, is considered as beginning upon first receipt of car home after responsibility is acknowledged by damaging line that car was in flood.'

"The Committee feels that the above interpretations will be of assistance to all concerned in handling unsettled cases. On behalf of the Arbitration Committee."

Rule 32

Section (12-a), Contamination—All concerned are again cautioned that cars selected or placed for the loading of contaminating commodities must be confined to cars suitable only for rough freight loading.

Interpretation (9)—Modified to provide delivering line responsibility for replacing and securely tightening tank car dome covers hanging by chain, the same as for bottom outlet valve chamber caps.

*Part 2 of an abstract of a discussion of the changes in Interchange Rules presented at a meeting of the eastern Car Foremen's Association, New York, February 8.

† General foreman, M. C. B. Clearing House, Pennsylvania Railroad, Altoona, Pa.

Rule 34

Eliminated entirely as all freight cars are equipped with United States Safety Appliances or United States Safety Appliances, Standard.

Rule 57

New sentence added to wording on illustration to provide for use of alternate type of air hose nipple which has the word *Top* marked on face of one of the hexagon flat surfaces. Same must be mounted as shown in the illustration.

Rule 60

Note on illustration shown on page 137, covering method of stenciling for air brake cleaning, modified to clarify the intent that stenciling should be on either side or either end of the reservoir presenting clearest view from outside of car.

Sections (g) and (L), Notes—Eliminated and new Note added following this rule listing the air brake instruction pamphlets applicable to cleaning of air brakes. All concerned should familiarize themselves with the requirements of these pamphlets and perform the work strictly in accordance therewith.

Rule 66

Paragraphs (b), (d) and (h)—Modified to show that all work of repacking journal boxes must be performed as required by the A. A. R. Lubrication Manual.

Interpretation 4—Modified to indicate that list and two new Notes thereunder on page 223 (Rule 101) specify what types of spring packing retainers may be substituted for each other in repairs, and not to make new applications of same in separable bolted type journal boxes on freight cars.

Rule 69

Section (g)—Modified account cast-iron wheels advanced from Recommended Practice to A. A. R. Standard by letter ballot.

Rule 70

Sections (f) and (g)—Modified by omitting reference to *1-WT* wrought-steel wheels account changes in Rule 98-(i) involving basis of charges and credits for *1-W* wheels.

Rule 82

First paragraph—Modified by omitting reference to Paragraph (i-2) of Rule 98 changed by eliminating service metal basis for turned *1-W* Wrought-Steel wheels.

Wheel Gages—Figures 4-A, 4-B, 4-C, 4-D, 4-E, 7, 8-A and 9 modified to conform with similar Figures in revised Wheel and Axle Manual.

Rule 85

Last paragraph modified to provide a one-month period

of grace (to 13 months old stenciling) before failure of journal roller bearing units due to overheating becomes handling line responsibility.

Rule 95

Fifth and sixth paragraphs—Modified to show that credit at secondhand value should be allowed for missing *D* coupler body and parts, or *D* coupler and parts removed in good condition when applying another coupler. These changes are due to previous elimination of average credit prices for *D* coupler parts from Rule 101, Items 132 to 132-E.

Rule 98

Section (c-1)—Modified by eliminating reference to Paragraph (i-2) of this rule and adding "(except 1-WT wheels)" to make it clear that remount gage or limits will continue to not apply to turned one-wear wrought-steel wheels, as provided in Note following first paragraph of Rule 82.

Section (c-2)—Modified to show that single plate cast-iron wheels of the 650 lb. size are excluded from the scrap provisions of this rule because they are not made in the bracketed type.

New Section (c-8)—Added to provide for use of experimental "A.A.R.X.-2" and "A.A.R.X.-3" cast-steel wheels and to establish basis for disposition or credit when removed from service.

Section (i-1)—Modified to provide that charges and credits for *1-W* wrought-steel wheels shall be on basis of prices new, secondhand and scrap, the same principle as for cast-iron wheels, instead of service metal basis. Turned one-wear wheels shall be classed as secondhand if serviceable, when removed or applied. See comments above under Rule 9 for instructions as to what to show on repair cards.

Rule 101

Material Charges—Price adjustments have been made in line with recent quotations resulting in some minor increases and a few slight decreases.

The following changes have also been made in this Rule:

Items 51, 51-A, 51-B and 51-C—Modified by eliminating the words "Worn out." Some roads have been showing combined dirt collector and cutout cock as worn out, giving only the small scrap credit and making full charge as per items 51 and 51-B. This is a condition that seldom exists and cannot be determined at the car. Charge per items 51 and 51-B can now be made only when body is broken or bent and care should be exercised to show proper reason for removal, i.e. broken, bent or leaking.

Items 119, 120, 122 and 123, Notes—Modified by eliminating reference to knuckle locks as there is no difference between the price of high tensile steel and Grade B knuckle locks at the present time. However, billing repair cards should continue to show whether knuckles and locks removed and applied are *H T* or *G B* as per Rule 9.

Item 169-1, Fourth Note—Modified to provide that where car is not fully equipped with approved packing retainer devices, charge of 10 cents will be added to charge for repacking journal boxes to cover R&R or R of each such device. Billing repair card must show whether or not car is equipped with approved packing retainer devices and, if equipped, number of such devices R&R. Showing whether car is so stenciled is not required.

Item 194-D, Note—Eliminated account changes in Rule 98-i involving method of charges and credits for turned *1-W* wrought-steel wheels.

Items 214, 215, 216, 217 and 218—Modified to include additional types of No. 18 brake beams awarded certificates of approval.

New Section 1-A, following Item 250-L—Added to provide charges for short friction draft gears approved for cars of special construction, built new or rebuilt on and after January 1, 1950.

New Items 251-H and 253-J—Added to provide charges for short Cardwell V-18 and Miner A-100-D friction draft gears when classed as non-approved for 24⅝-in. pocket spacing, along with Miner A-69-XB and Cardwell L-11-S.

Brake Beams, Figure 2—Modified to include additional types of No. 18 brake beams awarded certificates of approval.

A. A. R. Approved Types of Geared Hand Brakes (Page 221)—Klasing Number D-1051 and Superior Number 726-B have been added to the "Vertical Wheel Type."

Superior Number 565-E has been added to the "Horizontal Wheel Type."

A. A. R. Approved Types of Journal Box Lids (Page 222)—Continental Transport Appliances, Ltd. lid No. 114 has been added to the 5 by 9 and 5½ by 10 sizes; Davis Brake Beam Company's No. 113 has been added to the 6 by 11 size; National Malleable and Steel Casting Co.'s "Flexo 4" No. 609 and Symington-Gould Corporation's No. B-270 have been added in the 6½ by 12 size.

List of Approved Packing Retainer Devices (Page 223)—This table is modified to show latest drawing numbers and a new Note added to designate which type of approved spring packing retainers may be substituted for each other in repairs per Interpretation No. 4 under Rule 66. The other new Note added prohibits new applications of same in separable bolted type journal boxes on freight cars, but if removed for any cause from foreign cars must be reapplied if in serviceable condition.

General

This Rule has grown from 13 items in year 1885 to nearly 300 items plus tables of weights, sizes, etc., with combinations. The prices were rather frozen during Word War II, considerably increased since, mostly due to the large increase in labor costs. Similar occurred after World War I. Table I shows the changes in the principal items at five stages since year 1895.

Rule 107

Labor Charges, Item 28, Note—Modified to indicate that the use of not less than a 36 in. (instead of 48 in. minimum length) wrench must be used in tightening tank

TABLE I

Year	Forgings	M. I.	C. S.	H. Sprgs.	Chain	Lumber	⅝ inch or over Rivets	Freight Labor
1895	0.03	0.03	0.05	0.035	0.05	0.025	0.10	0.20
1941	0.065	0.075	0.10	0.055	0.08	0.06	0.22	1.40
1948	0.10	0.15	0.15	0.085	0.13	0.13	0.34	2.25
1951	0.10	0.20	0.17	0.095	0.16	0.155	0.42	2.80
1952	0.105	0.215	0.185	0.10	0.18	0.165	0.47	3.15

TABLE II

Labor, Per Hour	1-38	12-41	2-44	6-46	9-47	9-49	8-51*
Freight	1.25	1.40	1.60	1.95	2.25	2.80	3.15
Passenger	1.40	1.55	1.75	2.15	2.50	3.10	3.45
Tank	1.45	1.60	1.85	2.25	2.60	3.20	3.60
Lubricating and Cleaning	1.00	1.10	1.25	1.55	1.80	2.25	2.55

* During year 1951 there were three increases due to awards granted the employes, which made the A. A. R. freight car repair rates per hour—$3.00 effective March 1, 1951; $3.10 effective May 1, 1951; and $3.15 effective August 1, 1951 based on awards of 12½ cents, 6 cents and 1 cent respectively. Effective February 1, 1952 this rate goes to $3.20 due to the 4 cent award to employes. This latter was issued January 7 by the A. A. R. Secretary by circular letter and increased by total of 35 labor items in the Freight and Passenger Rules.

car outlet valve cap. Does not prohibit use of 48 in. wrench, nor wrench of any length 36 in. or longer.

Item 29, New Note—Added to provide same charge for reapplying and tightening tank car dome cover hanging by chain, as for bottom outlet cap, on authority of defect card. Care should be exercised at interchange points to see that defect cards are obtained for dome covers hanging by chain. See revised Interpretation No. 9 of Rule 32.

Table II shows the increases since year 1938.

Rule 108

Item 2—Eliminated account all brake shoe keys now in freight service are either A. A. R. Standard or A. A. R. Alternate Standard. This iem made other type non-chargeable.

Rule 111

Item 15-b-8, Vent Protector—Eliminated account original application of vent protectors has no doubt been completed and allowance for defective or missing vent protector is included in charge for cleaning AB brakes.

When vent protector is renewed account defective or missing and not in connection with cleaning AB brakes, charge per Item 53 of Rule 101 and Item 25 of Rule 111 is in order.

Item 28, second Note—Modified to clarify the intent that charge is permissible for labor and material for riveting or welding, bolts and lock nuts, securing any type AB cylinder, reservoir, pipe bracket portion, or other air brake devices to their brackets or securing their brackets to car body, whether or not cleaning type AB brakes is involved.

Passenger Car Rules

Rule 2

The effective dates of the following Sections have been extended to January 1, 1953:

Section (e)—Cardboards or suitable receptacles for Defect Cards and Joint Evidence cards.

Section (f)—Brake shoe spark shields.

New Section (j)—Added to provide that passenger equipment cars equipped with Pitt type couplers will not be accepted from owners on or after January 1, 1955.

Rule 7

New Section (e)—Added to provide that the same requirements now specified in Freight Rule 69, regarding the machining and mounting of wheels and axles, per Section *XX* of the A. A. R. Wheel and Axle Manual also applies to passenger equipment cars for interchange service.

Section (f-4)—Second paragraph modified to indicate that standard steel wheel gage specified is Figure 4-E of Freight Code as well as Figure 128 in Wheel and Axle Manual, for use in determining whether height of flange (tread worn hollow) on wrought-steel wheels is 1½ inches or more.

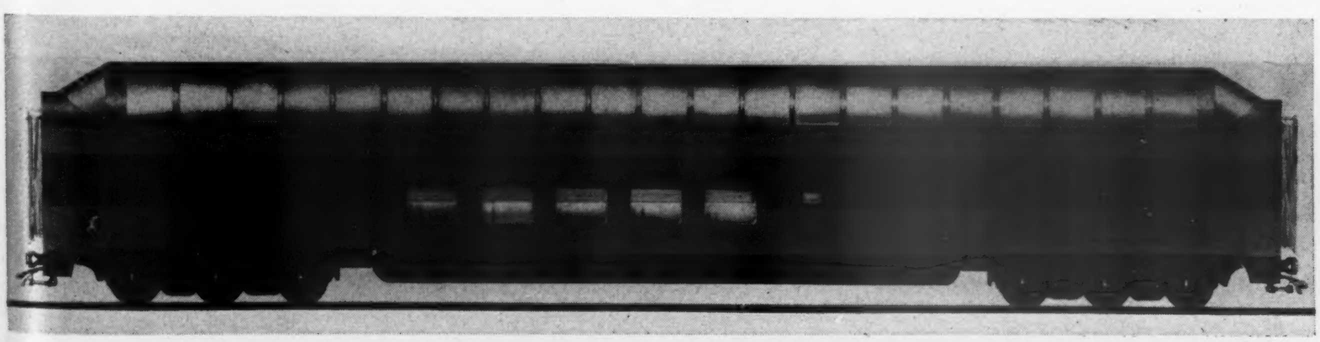
Section (j-2)—Modified and list of air brake instruction pamphlets applicable to air brake cleaning added to clarify the intent. All concerned should familiarize themselves with the requirements of these instruction pamphlets and see that the work is performed strictly in accordance therewith.

Rule 13

Section (b), Item 2—Eliminated account all brake shoe keys now in passenger service are either A. A. R. Standard or A. A. R. Alternate Standard. This item had made other types non-chargeable.

Rule 22

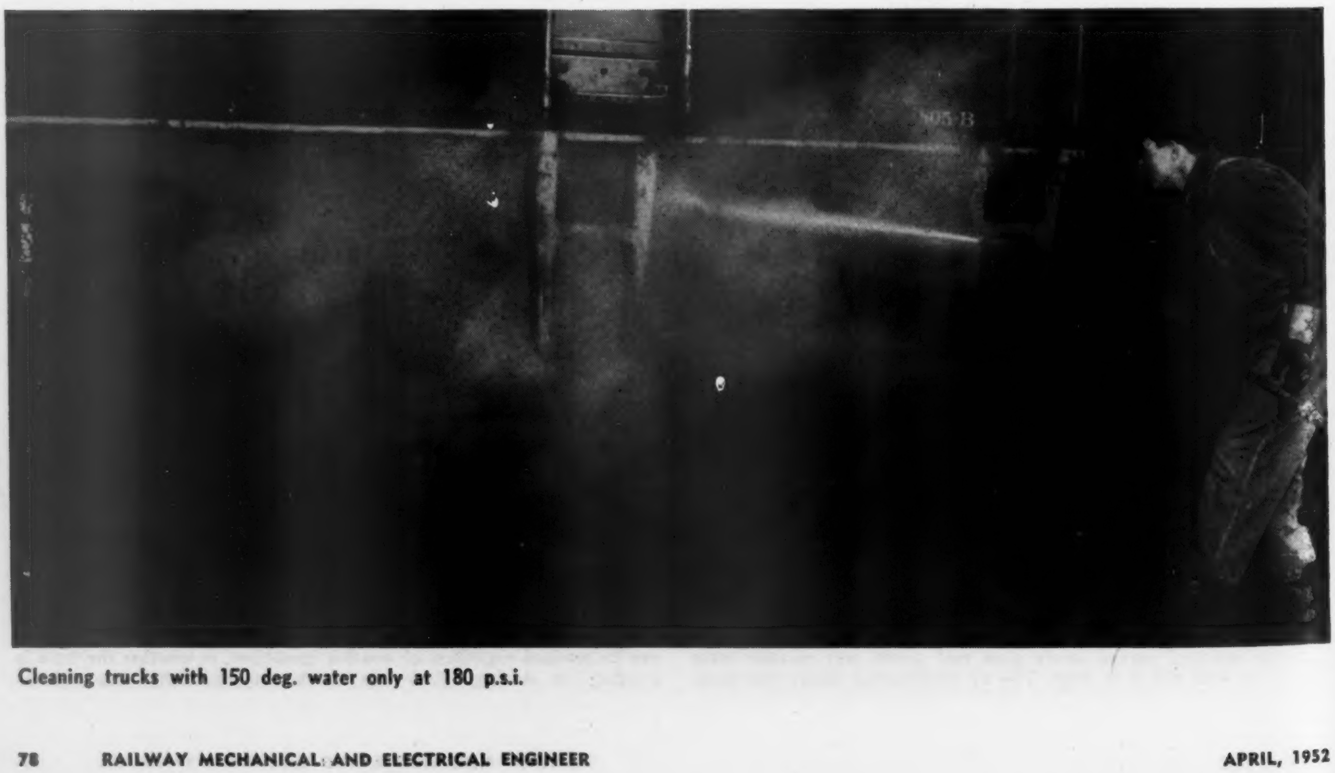
Material Charges—Adjusted in line with recent quotations resulting in some minor changes. Where Stores Department cost is chargeable, show the price, account and reference numbers on Repair Card.



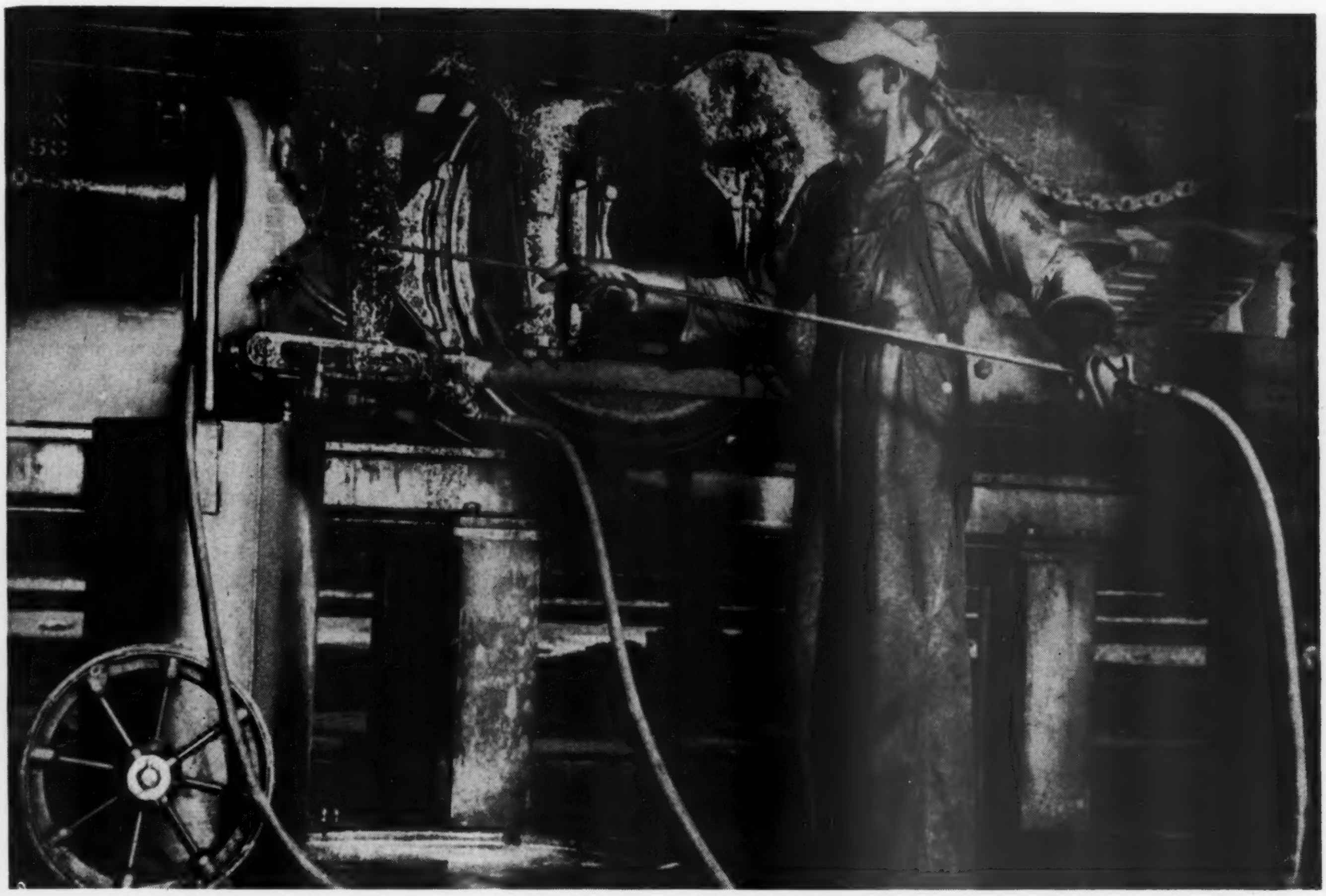
Ten full-length dome observation-lounge cars will be constructed for the Chicago, Milwaukee, St. Paul & Pacific by the Pullman-Standard Car Manufacturing Company beginning early this summer. The cars will have an overall length of 85 ft. and a height of 15 ft. 6 in. from the rails. The trucks will be six-wheel, with a 6½-in. by 12-in. journals. The heat-resistant curved safety glass roof panels will measure more than 3 ft. wide and 5 ft. high. The air-conditioning observation-dome section will seat 68 passengers. Beneath the dome will be a dining and lounge section seating 28, with an all-electric stainless-steel kitchen. A portion of the lower level space over the trucks will house air-conditioning equipment, air compressors, diesel enginators, and fuel and water tanks. The housing of this equipment is so designed that the equipment can be serviced regardless of weather conditions, or whether the train is standing or moving. Each car is thus mechanically independent.

Hand washing the exterior of a diesel locomotive unit.

Standardized Diesel Cleaning Pays



Cleaning trucks with 150 deg. water only at 180 p.s.i.



Applying cleaning solution to diesel under carriage

Dividends on the G. M. & O.

Easier inspection, fewer failures and a saving of $165,000 on three-year insurance premium are reported as a result of improved methods.

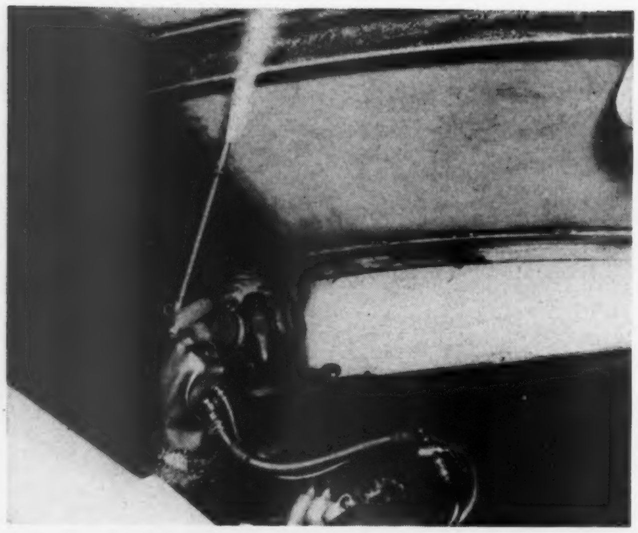
By Wayne Lasky

Engineer of Tests, Gulf, Mobile & Ohio, Bloomington, Ill.

Concrete wash track at the Bloomington diesel house

The Gulf, Mobile & Ohio does not intend to infer that it has the cleanest diesels in operation. However, the over-all improvement in cleanliness during the last two years has been remarkable. At one time, many exceptions were being taken by federal inspectors and occasionally it was necessary to hold diesels out of service until the hazards were eliminated. Recently a two-week

Abstract of a paper presented at the Southern and Southwestern Railway Club, March 20, 1952



Flushing the ceiling of an Alco diesel unit

survey was made of all the diesel power on the railroad by a fire prevention engineer from the Railroad Insurance Association. Management announced that the 3-year fire insurance premium on the diesels involved had been reduced $165,000, or a saving of $55,000 a year. The over-all diesel cleaning program along with the diesel lubricating oil control program were credited as the two items having the most influence on this reduction.

Tested Cleaning Methods

The G. M. & O. is completely dieselized, having operated its last steam locomotive in October, 1949. After becoming fully dieselized it was realized that the cleanliness of diesels was far from satisfactory although the total cost of cleaning, mostly labor, was excessive.

In the engineroom many places, not readily visible to the eye at casual inspection, harbored heavy accumulations of oil, grease and dirt which had not been cleaned due to their inaccessibility for hand cleaning. Such places as the Vee of the engine, back of the individual fuel pump on Alco units, portions of the air compressor, air brake equipment, filter tank and many inaccessible corners, cracks and crevices which could not be cleaned easily by hand, were being satisfactorily cleaned only during overhaul and were definite fire hazards. Our housekeeping at that time reminded us of the housewife that sweeps the dirt under the carpet and piles everything loose into the closets to get it out of sight and hurriedly flips a dust rag here and there scattering the dust. I.C.C. federal inspectors were beginning to give the railroad defects due to some of the dirty conditions existing.

Although trucks and underframes were being washed quite frequently, heavy sludge deposits on and around the diesel fuel tanks, and other deposits on the running gears and underframe were potential fire hazards.

Running gear and wheel inspections were not efficient at times due to the accumulation of dirt on the parts involved. The morale of shop forces responsible for inspections and repairs was at a low ebb due to the handicaps of working on dirty equipment.

It was decided to make a thorough survey of the entire railroad, studying the availability of diesels at the different terminals for maintenance and also the man power available to perform the work. A study was also made of the different cleaning materials and the methods of application, giving preference to cleaning equipment and materials which would clean satisfactorily with a minimum amount of hand labor.

Cleaning compounds were selected which showed little corrosive action on metals and caused a minimum of deterioration to painted surfaces when used at any concentration. Compounds which proved toxic, irritating to the skin or lungs and appeared likely to develop into health hazards were eliminated from consideration.

Fourteen terminals were selected to perform heavy cleaning on diesel units, the cleaning program or cleaning procedures being divided into three major items or classes: (1) Exterior carbody; (2) underframe (trucks, traction motors, fuel tanks, etc.); (3) interior (engine room—diesel engine—accessories and cab).

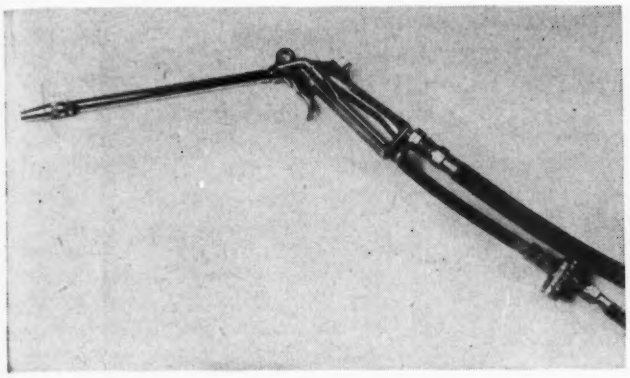
Cleaning the Exteriors

It was found that diesel locomotive exterior carbody cleaning could be satisfactorily accomplished either by machine washing or hand washing. Where car-washing equipment is available, locomotives can be washed by passing the diesel units through the car washer. Inasmuch as the primary use of the car-washer equipment is for washing passenger cars, we did not make any changes in the washing procedures, using the same cleaning material and rinses as used for passenger cars. It was found beneficial, however, to have hand labor scrub the nose and aprons of the diesel in between the application of the cleaning material and the water rinse as the brushes on washer did not contact these surfaces.

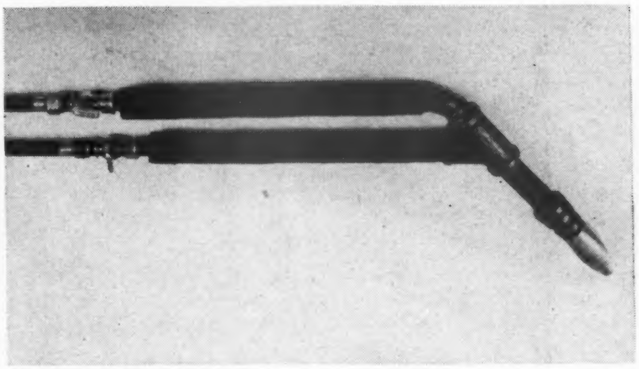
About 90 per cent of the diesel units were not available for washing in the car-washing equipment, so hand washing procedures were adopted as standard at most terminals.

Two basic type cleaners have been found satisfactory, either the acid type or the mild-alkaline type. If the exterior surfaces of the units do not become excessively greasy or oily, the acid-type cleaner is effective for removing the dirt, road film, brake shoe and rail dust, etc. If the exterior surfaces collect considerable oil and grease the mild alkaline-type cleaner has been found beneficial, but continued use does not result in as bright a surface finish or gloss as the acid type. All of the acid-type cleaners we have tested, however, are corrosive to metals. Those with a base of sodium acid sulphate have been found considerably more corrosive than those using oxalic acid. This has been shown both in laboratory tests and results from use in the field. Due to the corrosive characteristics of all acid-type cleaners, some railroads have adopted the practice of pre-wetting all the exterior surface with water before the cleaning solution is applied. With this procedure, plain water will enter all the cracks and crevices and any acid entering later will be considerably diluted.

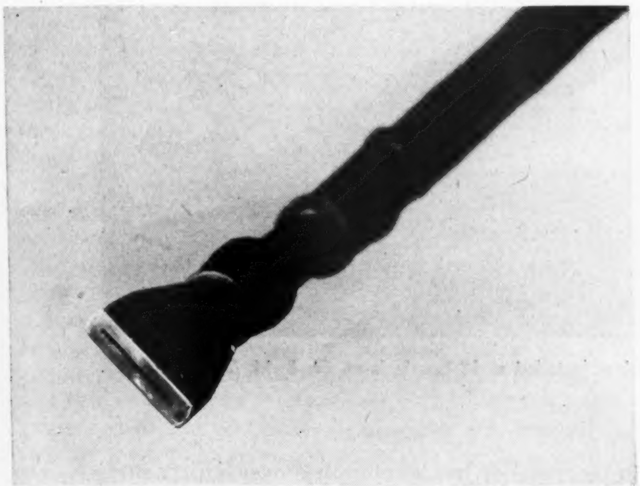
An example of the effect of the corrosive action of some types of exterior cleaners is clearly illustrated by experience at the G. M. & O. passenger car terminal in Chicago. A new car-washing machine was installed and placed in operation in July 1947, using a sodium-acid-sulphate type cleaner. In July 1949, after two years service, it was necessary to replace the two large solution tanks which were leaking badly and were corroded beyond repair. It was also necessary to replace most of the piping handling the cleaning solution. During the two years of service the maintenance forces were constantly replacing valves, elbows, nipples, etc., at considerable expense. Inspection of passenger cars showed considerable corrosion, especially under the side sheets and around the vestibules.



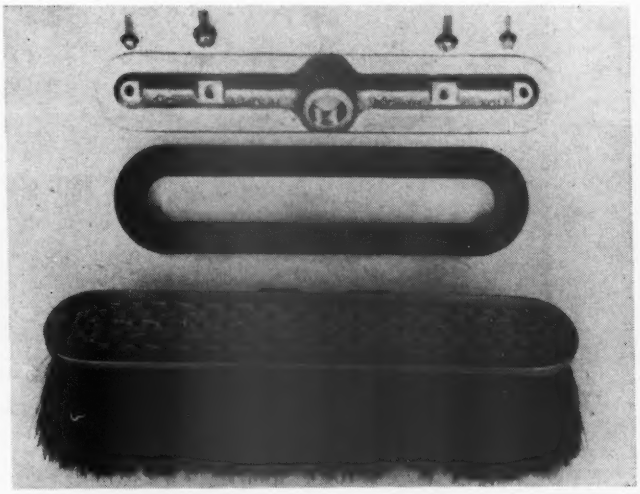
Air-operated vacuum pick-up type spray gun



Spray gun. All pipe fittings except nozzle and valves



Nozzle used in spray gun made of pipe fittings



The fountain brush disassembled

The machine was placed back in service in August, 1949, using an acid-type cleaner which had been found considerably less corrosive to metal. Since that time repairs and replacements to this equipment due to corrosion have been negligible.

The type of exterior finish on the diesel locomotives also enters into effectiveness of cleaning procedures to maintain clean and attractive diesel exteriors.

Most diesel units, as received from the engine builder, are painted with lacquer, said to be used in preference to enamel due to production line methods. Tests have shown that the general exterior paint condition of a diesel unit can be maintained for longer periods if painted with enamel and topped with a protective coating of varnish. The cost of repainting units with enamel and varnish also is less than with lacquer, mainly due to reduced over-all labor involved. Some protective coatings are now available which can be sprayed over lacquer finishes and extend the life of the lacquer considerably. Field tests over 1½ years have shown these protective coatings to be practical and economical. Painted surfaces with protective coatings appear to collect less soil and are more readily cleaned.

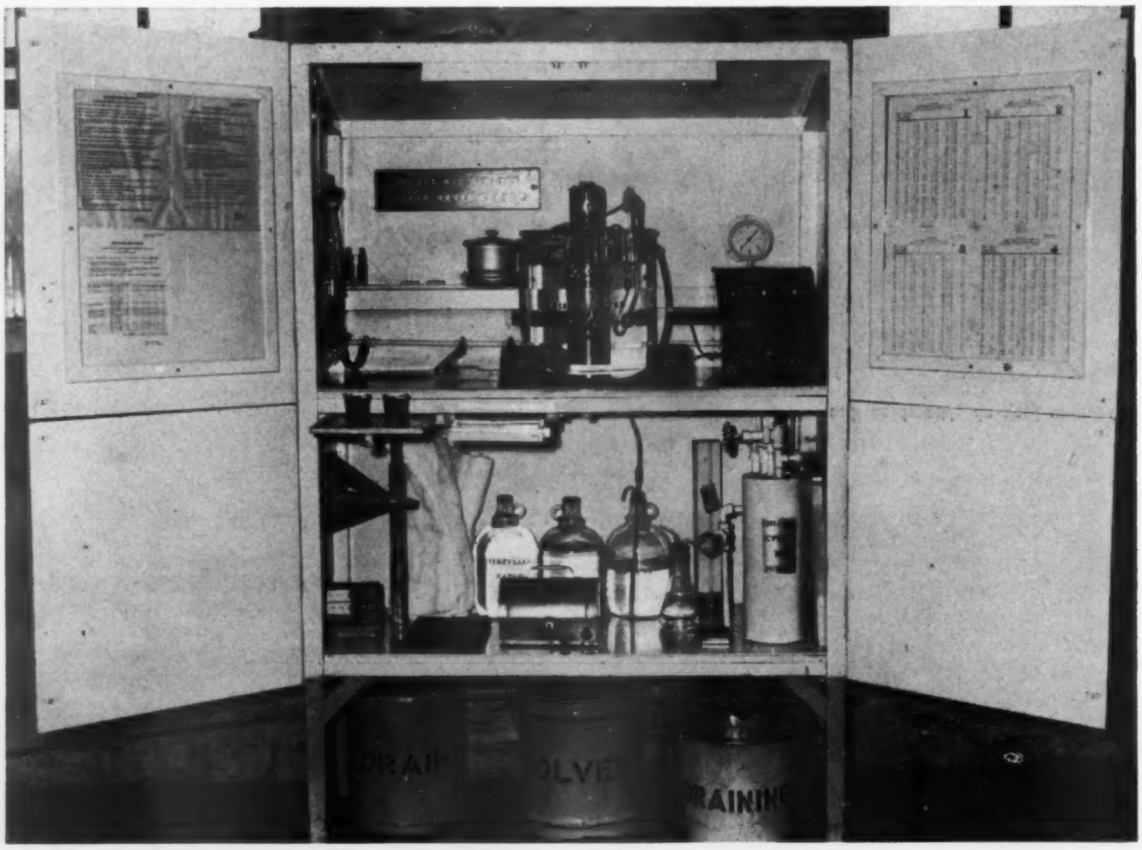
Underframe Cleaning

In addition to the over-all appearance of the trucks, traction motors, fuel tanks, battery boxes, etc., poor housekeeping of the underframes or running gear contributes to fire hazards and prevents effective pit inspections. Heavy accumulations of oil and grease on the running gear offer excellent opportunities for fire to start and cause extensive damage. Accumulation of grease, oil and dirt on the vital parts to be inspected can obscure defects and tends to promote careless inspections by maintenance personnel. Rigid inspections are necessary to prevent costly failures.

Recently a serious derailment was experienced near Muncie, Ind., in which 14 employees and 59 passengers were injured. Investigation showed the derailment to have been caused by a broken diesel wheel. Good housekeeping will keep these parts clean so that cracks and defects can be seen at time of inspection and the defective part removed before failure.

The survey on the G. M. & O. showed only a few terminals where adequate underframe or truck-cleaning facilities were available. Many terminals did not have adequate steam or hot water, so a cleaning method was required which would be applicable without these items.

A method was adopted using an emulsifying-type grease-solvent cleaner mixed with diesel fuel oil, applied lightly to the underframe by means of a pressure tank and fan-type spray nozzle. The solution is allowed to soak for a short period and then the cleaner and soil are flushed off with water at as high a pressure as available, using hot water whenever facilities permit.



Diesel crankcase oil and cooling system water-control cabinet installed at 15 terminals on the B. M. & O.

Ramp at Porter shops, Mobile, showing diesel cleaning equipment

However, it has been found that satisfactory cleaning of the running gear of diesels can be accomplished without the use of any chemical cleaning compound, if it is possible to have an abundant supply of hot water at a very high pressure. At the present time our most satisfactory and most economical cleaning is being accomplished with only the use of water at about 150 deg. F., at a pressure of 180 p.s.i. The hot water at this pressure will satisfactorily remove all grease, oil and dirt accumulation.

It will also remove any paint that is not well bonded to the metal or has been applied over a dirty surface. The parts can be cleaned satisfactorily enough for repainting after drying. In some instances a thin gray or brown "road film" will remain on the painted surface which is only objectionable from the standpoint of appearance. One of several different chemicals can be lightly sprayed on the affected parts and a quick flush will bring back the paint luster.

One view shows truck cleaning equipment in operation. The average time required for one man to clean the running gear, underframe, fuel tank, traction motors, etc., is about 30 min. The maximum hot water delivered at each station varies from 28 gal. per min. to 30 gal. per min. depending on the number of stations in service at one time.

Diesel Interior Cleaning

Engine-room cleaning had previously been accomplished by hand wiping, with occasional hand washing of the ceilings and the walls. Many places in the engine room or around the diesel engine and its accessories can not be reached by this method. Some points of potential fire hazards in the engine room were just not being cleaned. The over-all cost of engine-room cleaning, mostly labor, was excessive due to the time required and yet the engine rooms were not satisfactorily clean.

The method adopted for engine-room cleaning consists of spraying the entire engine room, ceiling, walls, engine, accessory equipment and floor with the same emulsion-type cleaner as used on the underframes. The material is allowed to soak and the dirt and cleaner rinsed from the surfaces with a hot water spray. The same spray gun is used both for application of the clean-

ing solution and rinsing with hot water. It is an air-operated vacuum pick-up type spray gun which applies the cleaning solution and the water with considerable force. The cleaning compound is not toxic, non-irritating to the skin and non-injurious to paint. It is mixed witn fuel oil before using, the concentration of the cleaner depending on the dirtiness of the engine-room parts.

If the entire engine room is to be cleaned, canvas covers are placed over several parts of the electrical equipment to prevent damage, the carbody air filters removed, all doors opened and air movers installed in the diesel unit. The cleaning solution is applied first to the ceiling or upper portion of the engine room, working downward until all portions have been thoroughly sprayed. Hot water is then used to flush all dirt and cleaner to the floor. If the soil on the ceiling and walls is heavy and consists of mostly dry carbon it may be necessary to loosen the soil by scrubbing before rinsing.

The characteristic of soil on the engine, air-brake equipment, filter tank, oil cooler, compressor, etc., is such that wiping or scrubbing is not usually necessary. Flushing with water usually leaves these parts satisfactorily clean. The spray gun can be used for directing much of the soil, which has been washed to the floor, down the drains or out into the aisles where it can be more easily mopped up. Such items as the air compressor and air-brake equipment formerly required eight man hours to hand wash satisfactorily. It was found possible to do the same job in about one hour using the spray-gun method.

In one illustration, the operator is seen flushing off the ceiling of an Alco locomotive. He is seated on top of the engine and it will be noted that he is wearing a respirator and rubber gloves as safety measures. In spraying diesel engines between cylinder heads and in behind fuel pumps, some points are not accessible for hand cleaning and others cannot even be seen. Cleaner solution is sprayed until the solution draining from behind these parts no longer appears dirty.

Cleaning Time Required

Shortly after the program was started the average diesel unit required approximately 1¼ man hours for exterior carbody cleaning, 1¼ man hours for the underframe and about 20 man hours for cleaning the engine room. However, more often than not the diesel unit could not be held long enough to clean the entire engine room, especially if other maintenance or repairs were necessary. In many instances, the carbody and underframes need cleaning several times before the engine room requires cleaning again. It was therefore necessary to divide the engine-room cleaning into several sections such as the roof, sidewalls, accessory housing, turbocharger, filter tank, air compressor, oil cooler, blower drive housing, air brake equipment, steam generator, etc.

On one trip into a cleaning terminal, a few of the items can be cleaned during the time available. Other sections of the engine room can be cleaned on successive trips. The mechanical foreman in charge is responsible for inspecting the unit and designating the items in the engine room to be cleaned. Forms have been printed including all of the different items on the cleaning program. After any cleaning work is performed on a diesel it is checked off on the form and forwarded to a central office where a composite report is tabulated. Thus the progressive cleaning of any diesel can be followed and the work accomplished by each terminal evaluated.

These reports have disclosed many odd conditions and made it possible for them to be corrected. For instance, some diesels were having the roofs and sidewalls cleaned frequently but the engine, air brake equipment, compressor, etc., were being neglected. Some units were being cleaned as frequently as five times as often as other units. This condition of course was aggravated, inasmuch as most road diesels do not have a definite home terminal and the responsibility of maintenance and cleaning is shared between as many as eight or nine terminals.

As the cleaning program progressed and over-all cleanliness of enginerooms improved, the man hours and the cleaning material required decreased. Recent surveys indicate from 10 to 15 man hours are required to clean an entire engine room.

An air-operated vacuum pick-up type gun, in use for the past two years, has been satisfactory although, like any piece of equipment, it is subject to failure. The inner wall of the hose although made of neoprene rubber, may disintegrate allowing small pieces of rubber to plug the gun. The cleaning solutions and hot water must be kept free of dirt, lint, etc., for the same reason. The nozzle, if it becomes battered and out of shape, will not allow sufficient vacuum pick-up.

Field tests of another type of gun show considerable promise. This is a spray gun made entirely of pipe fittings with the exception of the nozzle which produces a fan-type spray, of water only, and reduces the time required for water rinsing about 15 to 25 per cent.

Oil Control Program

Inasmuch as the diesel crankcase oil control program has also been credited as having a part in the reduction of fire hazards, the following is a brief outline: A control cabinet, illustrated, is installed at 15 major terminals on the railroad. The apparatus it contains for checking oil quality includes one of the more accurate type viscosimeters operated at 100 deg. F., a sensitive water detector for determining the water content in the oil, if any, and the conventional blotter spot-card test. Many special features have been developed and incorporated in the cabinet to make it possible for non-technical personnel to operate this equipment efficiently. The equipment is operated by diesel house personnel, usually the general mechanical foreman or the mechanical shift foreman.

Road diesels are sampled every time they arrive at each terminal diesel house. This results in every engine being sampled at least once every 24 hr. and some engines more often, depending on the assigned runs. It requires a total of only 15 to 18 min. to check both the cooling water and the crankcase oil from four diesel engines. The diesel units are held during these tests and not dispatched until the oil and water have been O.K.'d by the foreman. If any unsatisfactory conditions are found they are corrected before dispatchment. The results of all tests are forwarded daily to the central laboratory where a running record of the analyses is maintained on each diesel engine.

By this frequent checking of the oil, serious fuel dilution has practically been eliminated. Excessive fuel dilution can cause seizure of pistons or distress to bearings, either of which will furnish the necessary "hot spot" conducive to crankcase explosions and fires.

At present we are averaging about 6,000 oil samples analyzed per month. This is checking oil more frequently than customary on most railroads. However, we believe it to be essential for economical operation. The initial cost of the program was not large. The upkeep or maintenance of the program is negligible. The dividends returned have been considerable in greater availability of diesels and in the reduction of costly failures.

Portable Gantry Helps In Car Repairs

A portable gantry crane has proved helpful in program repairs to a series of drop-bottom gondola cars at the Union Pacific shops, Omaha, Neb. It consists of two A-frames, each equipped with two wheels to bear on the top chord angle of one of the car sides and connected at the top by a 6-in. I-beam with center plate cut out for engagement with the crane hook.

The wheels in each A-frame are double-flanged, spaced about 30 in. on centers and mounted with a sliding fit on axle support bars so they can follow any irregularities in top chord angles as the gantry is moved along the length of the car. The 6-in. I-beam is equipped with an overhead trolley and ½-ton air hoist. Leg extensions on each side of the A-frames serve as a precaution against the gantry accidentally dropping off the car.

In operation, a set of 14 reconditioned drop doors is placed in the car with the shop crane. The small gantry crane is then used to drop these doors, one at a time, diagonally through the door openings and then pull them up into place while hinge pins are applied and the doors secured. This was formerly a long, hard job and somewhat hazardous as well. By use of the small gantry, a complete set of 14 doors is now applied in about 30 minutes.

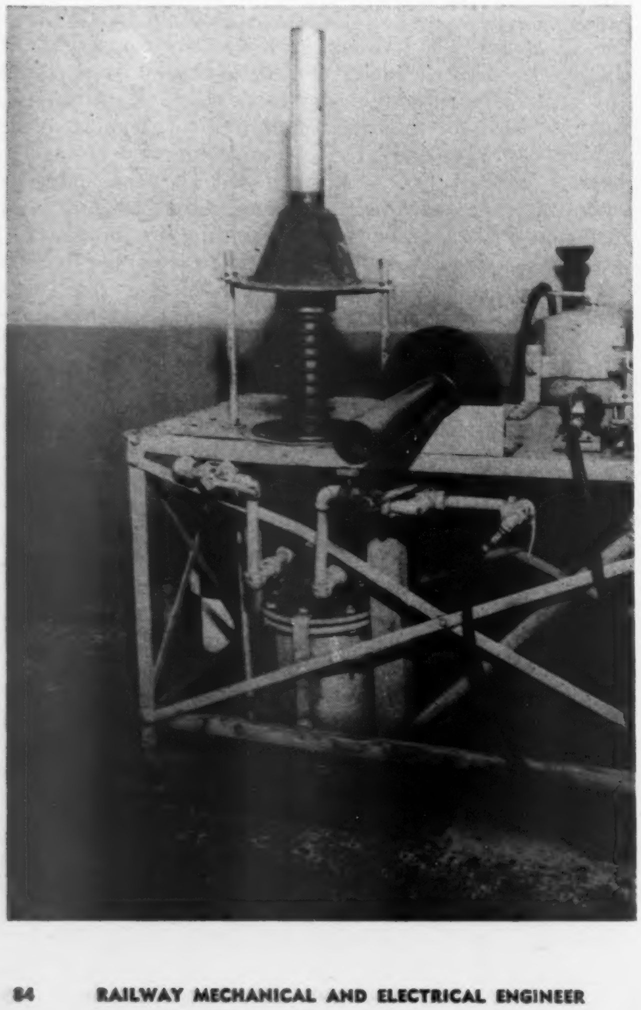
Portable gantry crane being used to install drop doors in gondolas

Better Working Height For Non-Pressure Heads

A somewhat different device than that used by most roads for assembling and disassembling AB pistons is employed by the T. P. & W. To place the non-pressure head in a more convenient position for removing the collar and other work, it is forced down to compress the spring by a pair of ¾-in. rods protruding upwards through a bench, the force being applied through a plate shaped approximately to the contour of the flange. The plate is held in place relative to the rods by ⅜-in. pins through holes in the rods.

This arrangement not only puts the non-pressure head at what is considered to be a more comfortable and convenient working height, but it puts everything in the open where the workman can more easily get at the parts. The movement of the rods is actuated by an 8-in. air piston mounted at floor level. A clevis on the end of the air piston rod connects to the two ⅜-in. rods.

The piston rod of the non-pressure head is cleaned just to the right of the assembling arrangement. The rod rests in a semi-circular hole in a plate mounted vertically on the bench, and is cleaned by an air-operated vibrating sander. The plate is of such a height that with the hole cut out for the piston rod, the rod is in a horizontal position and is easily turned for cleaning around the entire circumference.



Arrangement for working non-pressure heads at a comfortable working height and with everything in the open. The piston at the right is to be cleaned with the vibrating sander.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Lubricating Oil System

401-Q.—How is the lubricating system related to the locomotive unit? A.—The engine in each locomotive unit contains its individual lubricating system.

402-Q.—How does the lubricating system function? A.—All working parts are pressure lubricated.

403-Q.—How is the pressure supplied to the system? A.—By means of a gear type pump, gear driven from the engine crank shaft.

404-Q.—With respect to lubrication, under what type is the engine classified? A.—It is classified as a wet sump type.

405-Q.—Why is the engine so classified? A.—Due to the fact that all of the lubricating oil is stored in the engine base.

406-Q.—What is the condition of the oil in the engine base after it has circulated through the system and why? A.—The oil is hot and dirty. It has cleaned and lubricated the various working parts on its course through the engine.

407-Q.—What must be done before the oil is returned to the engine? A.—Means must be provided to clean and cool the oil before it is returned to the engine.

408-Q.—How is this operation initiated? A. — With the engine operating, the lubricating oil pump draws this hot and dirty oil from the base and discharges it to the system under high pressure.

409-Q.—What means are provided to limit this high pressure? A.—This pressure is regulated by a pressure regulating valve mounted in the pump discharge line.

410-Q.—What is the next step? A. — The oil is then passed through a filter where it is cleaned.

411-Q.—Is the oil now ready for use? A.—No. It is still hot.

412-Q.—What must be done to overcome this condition? A.—The oil is piped to a cooler where a portion of the heat is absorbed by the engine cooling water.

413-Q.—From the cooler, where does the oil pass to? A.—It is piped to a strainer where any remaining impurities are removed and then delivered to the main header of the engine.

414-Q.—What connection is made just before the oil enters the main header? A.—A portion of the oil is piped to the valve lever mechanism, cam shaft bearings, gear trains and turbo-supercharger bearings.

415-Q.—Where does the oil finally lead to? A. — It is returned to the engine base through various drain lines.

416-Q.—How are the main bearings lubricated? A.—Individual jumper pipes conduct the oil from the main header to each main bearing.

417-Q.—How does the lubrication get to the connecting rod bearings? A.—Drilled passages in the crankshaft allow the oil under pressure to flow from the main bearing journals to the connecting rod bearing journals.

418-Q.—In what manner are the piston pin and bushing lubricated? A.—From the connecting rod bearings, the oil passes up through rifled drilled connecting rods to hollow full floating piston pins, lubricating piston pin and bushing.

419-Q.—How is cooling of the pistons provided? A.—Through a passage in the main pistons, oil flows from the piston pins to oil cooling grooves in the pistons, terminating in an outlet hole, and draining back to the engine base.

420-Q.—What protection is afforded against loss of lubricating oil pressure? A.—At the end of the main engine header, a line leads to the engine control panel terminating in a pressure gauge and two low oil pressure switches which protect the engine against loss of lubricating oil pressure.

421-Q.—What is the total system capacity of oil? A. — 200 gallons on the 1500 h.p. Road Switcher and road Freight, and 230 gallons on the 2000 h.p. Road Passenger locomotives.

422-Q.—How is the system filled? A. — To fill the system, any engine base door can be removed and the oil poured through this opening.

423-Q.—How is additional make up oil supplied? A. — A filling connection is supplied at the free end of the engine for the addition of make up oil.

424-Q.—What precaution must be taken when about to fill the system? A.—Never remove a base door while engine is operating, as hot oil thrown from the operating parts may cause personal injury.

425-Q.—How is the system drained? A. — By removing a pipe cap from an external drain pipe and the drain plug in the engine base. In addition, there are three drain valves to open, one for the strainer and two for the filter.

426-Q.—How do we determine when oil should be added? A.—A Bayonet gauge is provided, with a high and low mark to indicate the oil level.

427-Q.—How often should the gauge be checked? A.—It should be checked daily.

428-Q.—What conditions should prevail at the time the check is made? A.—The engine idling, on a level track, crank case exhauster shut off and oil temperature near normal.

429-Q.—How should the level be maintained? A.—The level should be maintained between the High and Low mark, preferably at the High.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

430-Q.—What precaution must be taken after an oil check has been made? A.—Make certain that the crank case exhauster is turned on and operating.

431-Q.—What must be done if the lubricating oil is found to be above the base screens with the oil level at the high mark on the gauge? A.—The markings on the bayonet gauge should be checked and re-marked.

432-Q.—How should the gauge be marked? A.—*High* mark 9⅞ inch from the shoulder at the knob end of the gauge. *Low* mark 12⅞ inch from the shoulder at the knob end of the gauge.

Schedule 24 RL

Air Brakes

1284-Q.—In the event that a locomotive is detached from a train and is being moved in FRGT position, what should be done if an emergency arises?

A.—Move automatic brake valve handle quickly to emergency position.

1285-Q.—What movement should then follow?

A.—Quickly move the independent brake valve handle to full application position to nullify the controlled emergency feature.

1286-Q.—Should the independent brake valve handle be kept in this position?

A.—Yes. Until the stop is completed or the emergency has passed.

SUGGESTED PROCEDURE WHEN PIPES ARE BROKEN— AUTOMATIC BRAKE VALVE

1287-Q.—What function is lost if the equalizing reservoir pipe 5, is broken?

A.—The functions of service position are lost.

1288-Q.—What repairs to the pipe should be made?

A.—Close pipe to brake valve by a plug or a short close bend.

1289-Q.—What other opening should be plugged?

A.—Close brake pipe exhaust one-half inch with pipe plug or well fitted hard wood plug.

1290-Q.—Can the brake be applied?

A.—Yes.

1291-Q.—How can the brake be applied?

A.—Move the brake valve handle into the emergency position zone gradually, opening the emergency pilot valve only.

1292-Q.—What should be done if application pipe 10 is broken?

A.—If a service application portion is used, close cut out cock on front of brake valve.

1293-Q.—What operation is lost?

A.—Safety control, overspeed and train control operation.

1294-Q.—In the event that an emergency application portion is used, what must be done?

A.—Close cut-out cock if available, or close the pipe by a plug or close bend.

1295-Q.—What operation is thus lost?

A.—The functions of the emergency application portion are lost.

1296-Q.—What would be the result if brake pipe (No. 1) is broken?

A.—Locomotive and train automatic brakes are inoperative.

1297-Q.—Is a brake available on the locomotive?

A.—Yes. The locomotive independent brake is operative but the automatic brake valve handle must be placed in lap position.

1298-Q.—What should be done if control pipe 11 is broken?

A.—Cut out the electro-pneumatic brake and proceed, using automatic brake.

1299-Q.—In the event that governor pipe 29 is broken, what can be done?

A.—Proceed with high governor top in control.

1300-Q.—What must be done if the high pressure top governor pipe is broken?

A.—The compressor must be manually throttled to control the main reservoir pressure in first service, lap, service and emergency position.

1301-Q.—What must be done if safety control pipe 3 is broken between brake valve and foot valve?

A.—Proceed with safety control, controlled with the diaphragm foot valve only.

1302-Q.—Suppose that the pipe is broken between the foot valve and relayair valve unit?

A.—Close the cut-out cock on the service or emergency application portion or make a close tight bend to stop the leak.

1303-Q.—What feature is lost in this case?

A.—All functions of the application portion are lost.

1304-Q.—What action should be taken if sanding pipe 9 is broken between the brake valve and No. 15 double check valve (with brake-in-two protection feature)?

A.—Pipe must be repaired or manual brake valve sanding is lost.

1305-Q.—Suppose that a No. 15 check valve is not used?

A.—The break must be repaired or manual and automatic emergency sanding features are lost.

1306-Q.—What must be done if suppression reservoir pipe 23 is broken?

A.—Stop leak on brake valve side of the break by plugging or close tight bend.

1307-Q.—After plugging, what can be done?

A.—Proceed. Functions are the same as with rotair valve in *PASS.*

1308-Q.—What action should be taken if reduction limitating reservoir pipe 24 is broken?

A.—Close first service cut-out cock and proceed, using service position for automatic brake operation.

1309-Q.—Suppose that power cut-off pipe 25 is broken?

A.—Stop leak from the brake valve.

1310-Q.—What operation is thus lost?

A.—Power cut-off for any application portion operation is lost.

1311-Q.—What must be done if main reservoir pipe 30 is broken?

A.—Pipe must be repaired to have an automatic brake.

ELECTRICAL SECTION

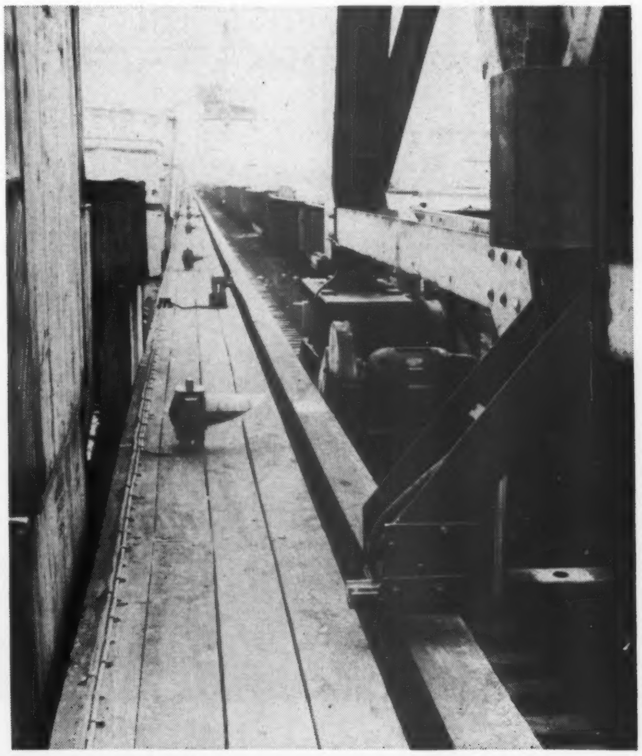


Fig. 1 (Left) — The Lackawanna's two 60-ton gantry cranes in its Hoboken, N. J., terminal yard

Fig. 2 (Above) — The tripping arm on the east crane is shown in the foreground. Along the platform are shown signal lights and one tripper switch. Three power contact rails for crane operation are enclosed by the platform and side housings

Lackawanna Develops Photo-Electric Crane Protection

Possible collision of two gantry cranes operating on the same track is prevented by means of a signal system using lights and photo-electric relays

THE DELAWARE, Lackawanna & Western employs two gantry cranes in its Hoboken, N. J., terminal yard to transfer lading from cars to barges or to storage in the yard. Barges to be loaded or unloaded are moved into a canal which is parallel and close to the crane runway. The two cranes operate on the same tracks. Distance between rails is 32 ft. and the length of the track is 1,550 ft. The cranes have a capacity of 60 tons at 60 ft., and are capable of lifting lesser loads at distances up to 125 ft. from the center of the crane.

Since the crane booms may be rotated 360 deg., it is not always possible for the operator to see the other crane. For this reason, it was necessary to devise some means of preventing a possible collision of the cranes. Track

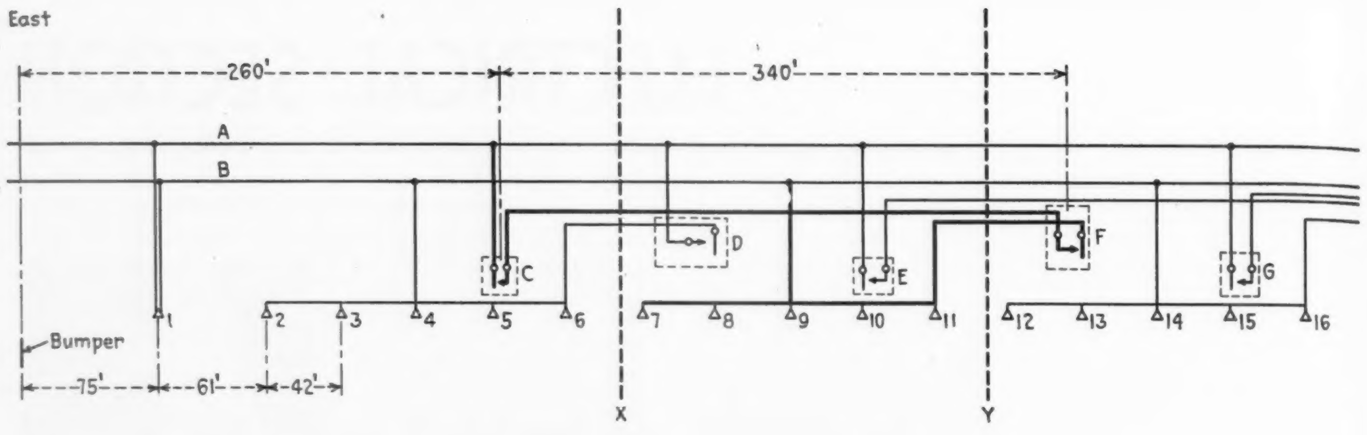


Fig. 4—One of the low tripper switches operated by the east crane and one of the lights

circuits could not be used, since the crane is operated by 440-volt a.c. motors, and it is necessary that the rails be grounded.

The requirement was met by a signal system employing mechanical trips, wayside lights and photo-electric relays. As either crane approaches the other, it sets up circuits by means of mechanically operated switches, until the cranes are within 340 ft. of each other. When this limiting distance is reached, five wayside lights between the two cranes are lighted. Then if either crane moves further toward the other, a photo-electric relay on the crane receives an impulse from the first light which energizes two flashing red lights in the crane operator's cab and two steady red lights outside the cab. The lights in the cab continue to flash as long as the cranes are within the limiting distance unless the relay is reset by the operator. They will start flashing again if he passes another light. As the cranes move away from each other, the mechanically-operated switches are opened by the movement of the cranes. This clears the intervening circuits, and the wayside lights are extinguished.

The manner in which this is accomplished is shown in

Left: Fig. 5—One of the high tripper switches operated by the west crane. Center: Fig. 6—A 25 c.p. signal light with its 115/6-volt transformer. Right: Fig. 7—The photo-electric relay on one of the cranes

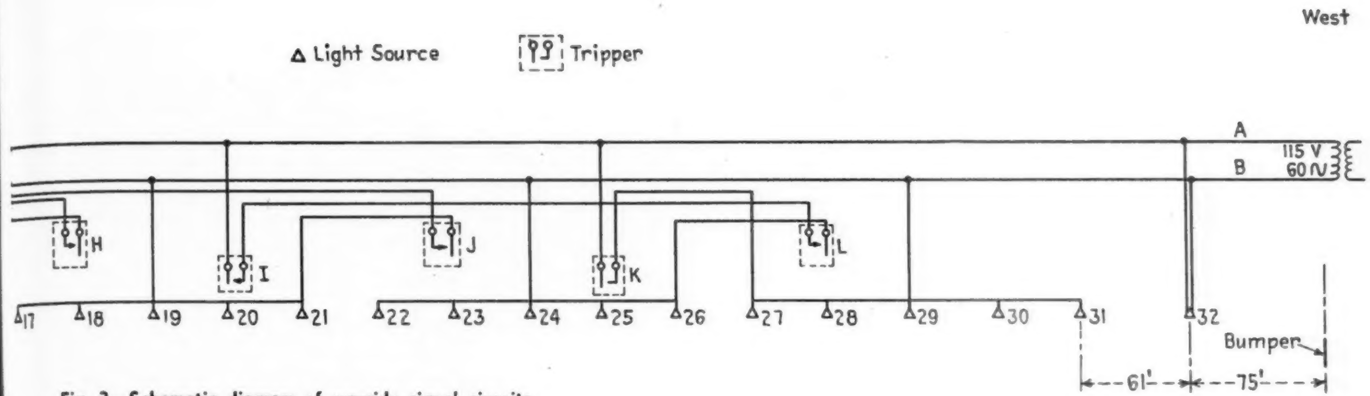


Fig. 3—Schematic diagram of wayside signal circuits

the wiring diagram, Fig. 3. The 115-volt, 60-cycle signal power lines *A* and *B* extend the full length of the crane track and serve to supply power to operate the lights Nos. 2 to 31 inclusive, through the tripper switches. The tripper switches *C*, *E*, *G*, *I* and *K* are closed by an arm on the east crane as the crane passes each switch going west. As it moves past each switch eastbound, the arm opens the switch. This arm is shown in the foreground in Fig. 2 and one of the switches it operates is shown in Fig. 4.

The west crane closes switches *L*, *J*, *H*, *F* and *D* as it passes them when moving east and opens them as it passes them while moving west. All of the switches operated by the east crane are mounted as shown in Fig. 4, while all of those operated by the west crane are mounted high as shown in Fig. 5, and the operating arm on the west crane is correspondingly higher so it will only operate the switches which are up on blocks. The switches are limit switches with a spring-return arm.

To follow the operation of the circuits, assume that the east crane has moved from the east end to the position indicated by the dotted line *X*, having passed and closed the switch *C*. Then assume that the west crane has moved east to the position indicated by the dotted line *Y*.

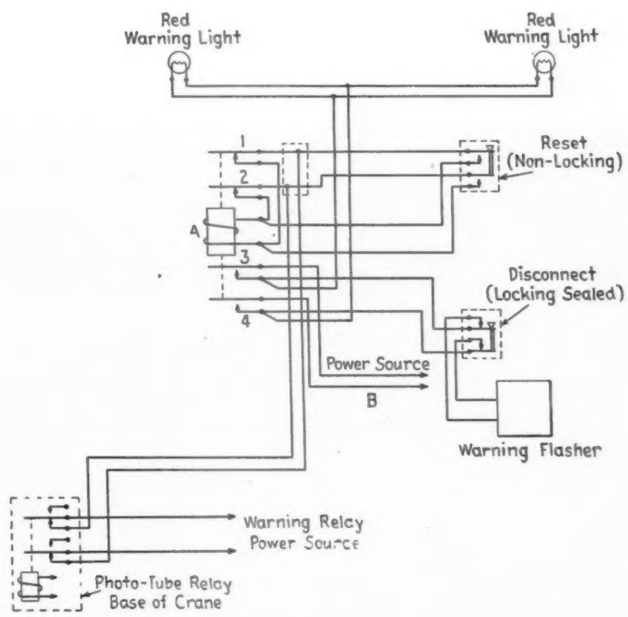


Fig. 8—Schematic diagram of the signal circuits of one of the cranes

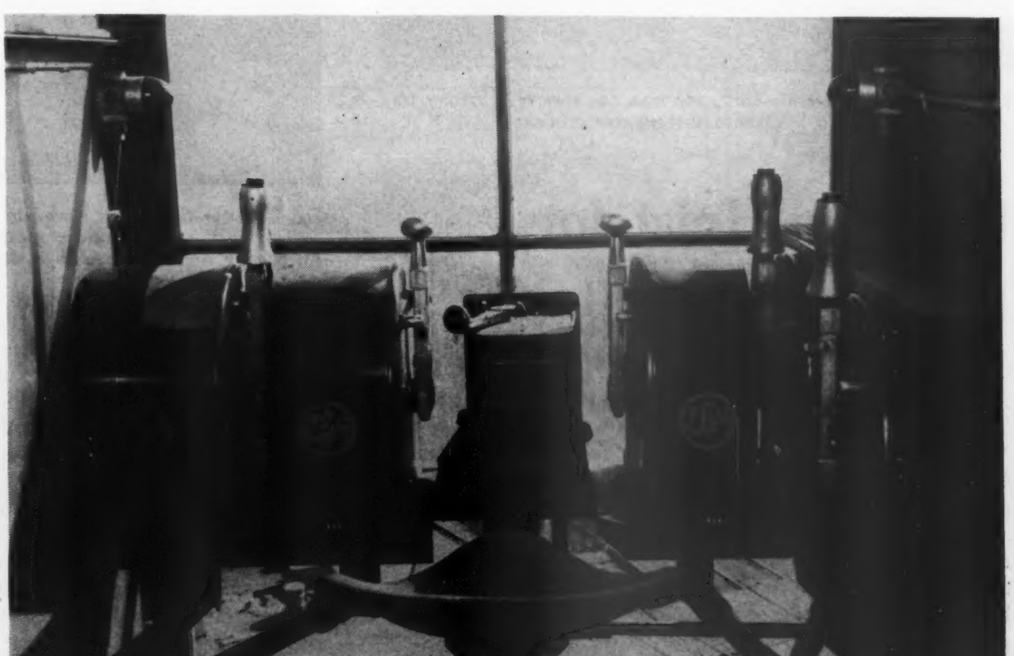


Fig. 9—The operator's position in one of the cranes showing the signal lights at the left and right of the window

As it passed the switch *F*, it closed it, causing wayside lights *7*, *8*, *9*, *10* and *11* to burn. One side of the line to the lights is energized through switch *C*, and the other through switch *F*. The completed circuit is shown by the heavy lines. One of the lights is shown in Fig. 6. The small transformer on the side of the lamp housing reduces the line voltage of 115 to 6 volts for the operation of the 25 c.p. lamp in the light unit.

Now, if the west crane moves farther to the east until its photo-electric relay (Fig. 7) comes in line with light No. *16* in the diagram, the relay trips and starts the warning lights in the operator's cab. Similarly, if the east crane moves west until its photo-electric relay is opposite light No. *7*, the operator of that crane will receive a warning signal. The distance between the lights and the photo-electric relays is about 4 ft. Accurate aiming of the lights is not necessary. The relays are general purpose outdoor type photo-electric relays with self-contained photo-tubes.

The signal circuits on the crane are shown in the diagram, Fig. 8. The contacts in the photo-electric relay, lower left, are normally energized, with contacts as shown. Solenoid *A* is in the upward position, and contacts *1* and *2* are closed. When the photo-electric relay receives an impulse from a light, its contacts are opened, and solenoid *A* drops down, closing contacts *3* and *4*, which connect the red warning lights to the power source *B*.

The operator may extinguish the red warning lights by pressing the reset (non-locking) button, but he will receive another warning if he should pass another light. In case of faulty operation, the operator may disconnect the lights with the disconnect switch (lower right), but this requires the breaking of a seal.

Fig. 1—With this portable hoist, one man can remove a battery tray from a locomotive battery compartment

Fig. 2—After the tray is moved to the battery shop, the rectangular opening in the base provides a place to put a skid under the tray. All battery work in the shop is done with the trays on these skids

Portable Hoist for Locomotive Batteries

A simple and effective device for removing or replacing battery trays in locomotive battery compartments has been developed in the Erie diesel locomotive shops at Marion, Ohio. It is of welded construction, and is made of steel angles and pipe.

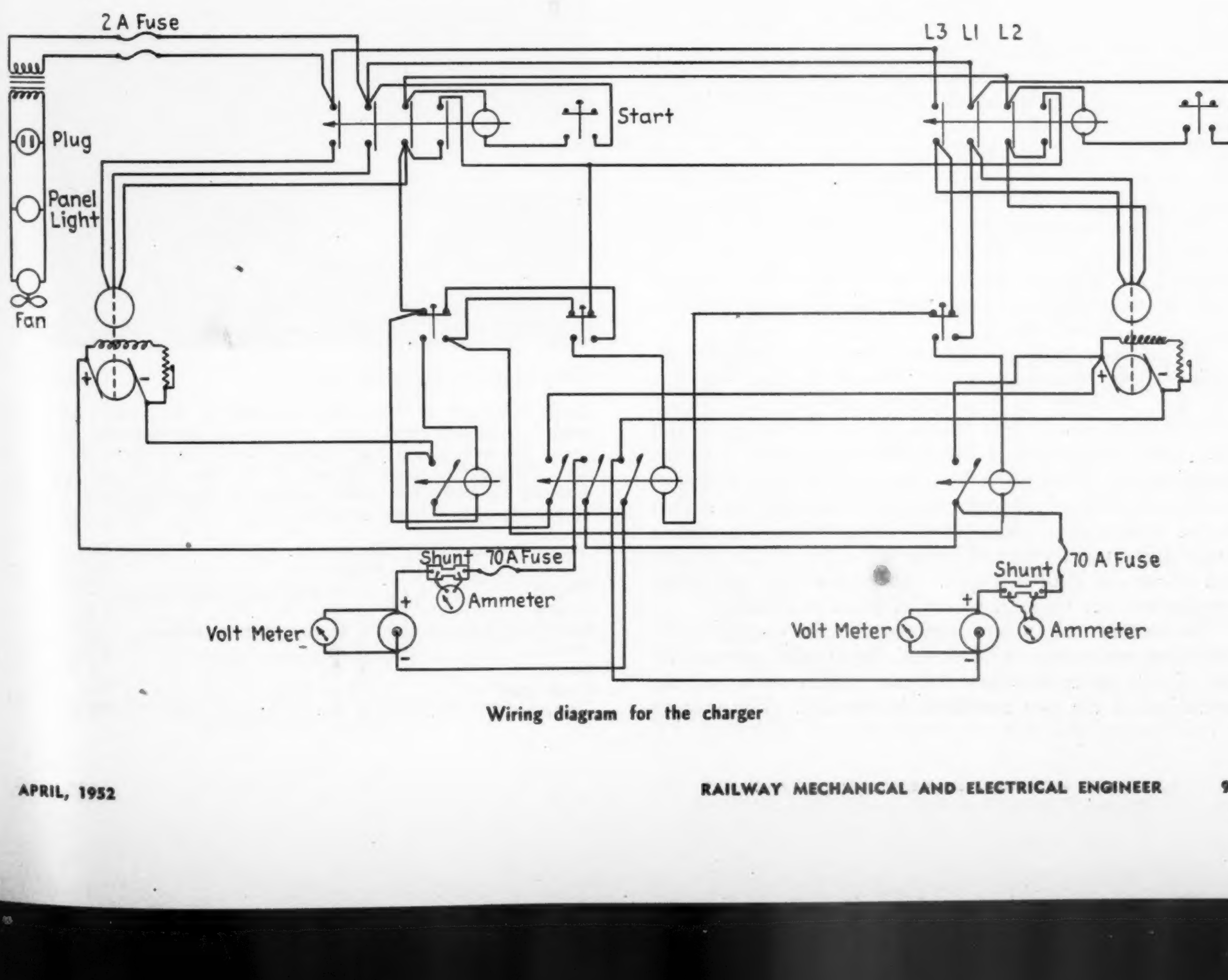
The base is triangular and is mounted on three 6-in. rubber-tired wheels. The vertical members, as shown in the illustrations, are made of angles. The horizontal member at the top is made of steel pipe, and there is a grooved pulley or sheave at each end of this member. A steel cable with a hook at each end runs over these sheaves.

When a battery is to be lifted, a lifting bar, which may be seen in Fig. 2, is hooked to the lifting lugs on the battery tray. One end of the cable is hooked into an opening in the center of the bar and a ratchet hoist is hooked between the other end of the cable and the base of the device as shown in Fig. 1. Taking up on the hoist then lifts the battery tray, after which the battery may be rolled to the battery shop, as shown in Fig. 2. The rectangular opening in the base of the device permits lowering the battery tray to the floor or placing it on a battery skid on which it is overhauled. By reversing the operation, a battery may be replaced in the locomotive battery compartment.

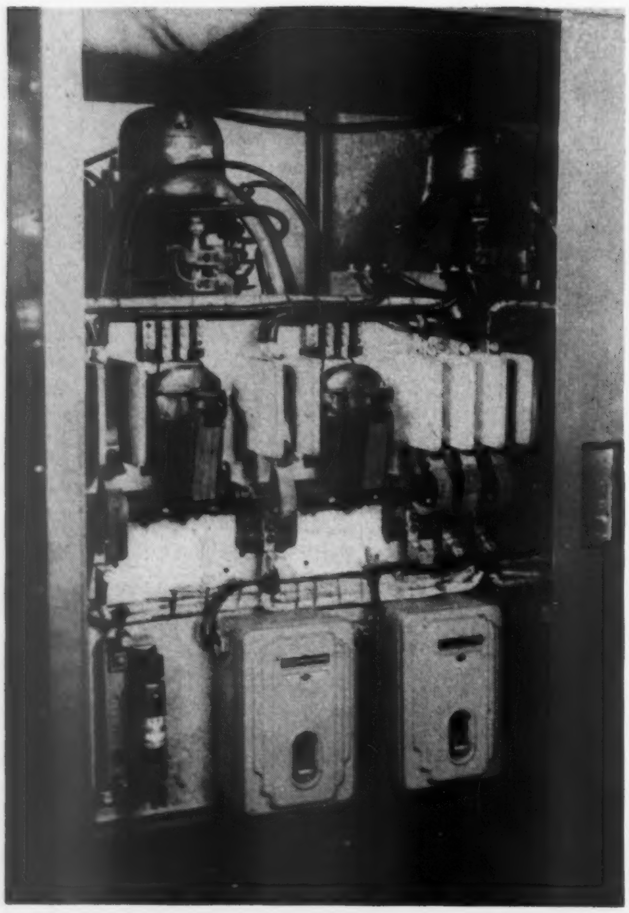
Left: The diesel battery charger in service. Right: The control panel showing meters, starter and circuit breaker pushbuttons, a.c. receptacle (center), two d.c. receptacles and a 110-volt a.c. outlet with cord connected

Charging 112-Volt Diesel Batteries

New Haven builds its own portable machine which operates on 550 volts and will charge 64- or 112-volt batteries



Wiring diagram for the charger



Interior view of the set showing the m.g. sets, the a.c. starter contactors and the d.c. circuit breakers

To avoid the need for starting diesel engines on locomotives with low batteries from a second engine, the New Haven was faced with the need of finding some way to charge 112-volt batteries from 550-volt, 3-phase power. The locomotives in question are serviced at the New Haven's Southampton street enginehouse, and the power available at this point is the 550-volt, 3-phase power supplied by receptacles located at every other stall and used for the operation of portable welders. The locomotives have 112-volt and 64-volt batteries.

There was no charging set on the market which would produce the needed charging voltage or which would operate on 550-volt power. Accordingly, the railroad built its own set from such materials as were available and others it could buy.

The railroad had on hand two Electric Products Company vertical motor-generator sets which have 4½-hp., 550-volt, 60-cycle motors and 64/72-volt, 50/30-amp. shunt-wound generators. These were old machines, and they were reconditioned before they were built into the charging set. They were then mounted on a rubber-tired truck with control equipment, and a housing as shown in the illustration. A.c. power is connected through a single 100-amp. receptacle, mounted at the center on one end under the control panel. There are two d.c. outlet receptacles, one on each side of the a.c. receptacle.

The controls are so arranged as to permit operating the machines separately or in series. Interlocks prevent the use of one machine when the two are in series or the operation of the two machines in parallel. The motors are started with push-button operated a.c. contactors with interlocks.

The generator field resistances have fixed values which produce open circuit separate machine voltages of 84 or 168 with the two machines connected in series. Full load amperes are 55, and the characteristics of the machines reduce this automatically to 14 amp. at full charge.

On the panel are two 0-200 voltmeters and two 0-100 ammeters, one ammeter and one voltmeter for each machine. A.c. circuits are protected with overload trips. The d.c. circuits are protected with 70-amp. fuses.

Also mounted on the truck is a 550/110-volt, 500-watt, single-phase dry type transformer. This is used to operate the controls, to run a ventilating fan and to supply an outlet shown in the lower left-hand corner of the control panel for portable extension lights. The ventilating air duct is closed by a shutter when the charger is not in service. This shutter is opened automatically by the ventilating air when the machine is running.

The charger was designed by and built under the supervision of George H. Tryder, general electrical foreman, New York, New Haven & Hartford, Boston, Mass.

They're Both Locomotives

Great and small, the two vehicles shown in the picture have one thing in common: they're both locomotives, but there the similarity stops. The midget will haul precious metals far beneath the earth's surface, while the larger is one of the new series a.c. electrics designed for high-speed freight service on the Pennsylvania. Here is a comparison of the two locomotives.

	Mining Midget	One unit of A.C. Electric
Weight	1 ½ tons	120 tons
Length	4 ft.	54 ft.
Power	5 hp. supplied by battery	2,500 hp.
Width	3 ft.	10 ft. 6 in.
Height	4 ft.	15 ft.
Track gage	18 or 24 in.	56½ in.
Top speed	4 m.p.h.	65 m.p.h.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

8 Inspection and Tests— Two Anti-Friction Bearings

Armature bearings will talk to you, and they will also talk back at you if you don't treat them right

A Study in Contrasts

Two remarkably different kinds of bearings work side by side in today's traction motors. They are opposites in almost every respect, yet each does a swell job. In all kinds of weather they work together in the tough spot down between the drivers, next to the roadbed.

We've already finished checking the motor suspension bearings and seen how easy they are to get at for inspection and measurement. But think about them again for a minute. They are large, simple sleeve bearings with plenty of running clearance all around. The limits of wear are generous. Yet, with only slight attention, they ride bareback on a stiff, bucking axle over thousands of miles of track.

There are still a lot of railway motors in service that have the same type of sleeve bearing on their armature shafts also. All that has been said about clearances, covers, wicks or packing, and oil supply apply just as well to these.

As locomotives grew in size, more and more power had to be packed into the motor space between drivers. Sleeve bearings were long and took up a lot of valuable space inside the motor. So they had to give way to compact anti-friction (ball and roller) bearings. The suspension bearings, being outside the motor, escaped this fate and are still with us as sleeve bearings, even on today's high-power motors.

The armature roller bearings are compact, sturdy assemblies of precision parts squeezed into the limited space allotted to them in the motor frame. The clearances and tolerances are exacting and small. Like the works inside

This is the eighth of a series of articles on maintenance of diesel-electric equipment. This article is written by J. W. Teker, Locomotive and Car Equipment Department, General Electric Company, Erie, Pa.

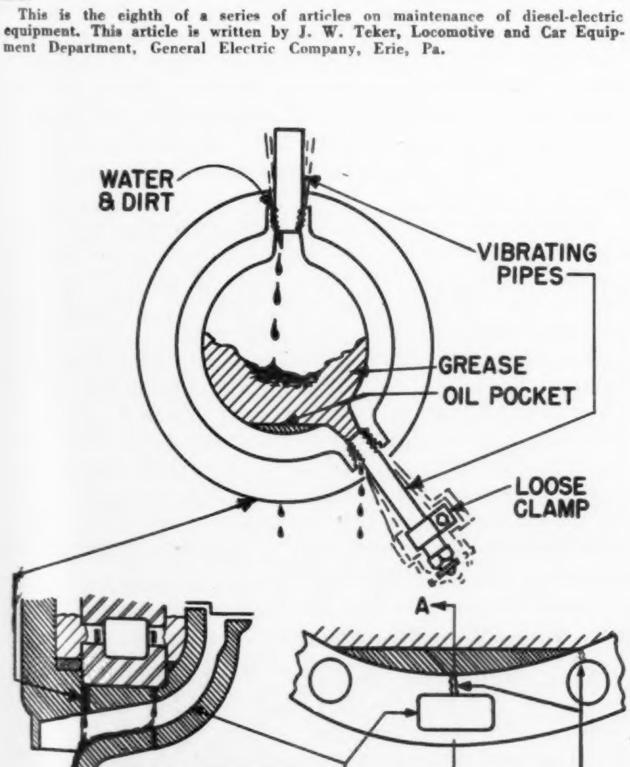


Fig. 1—Tight drain and grease pipes and good gaskets are a "must" on antifriction bearings

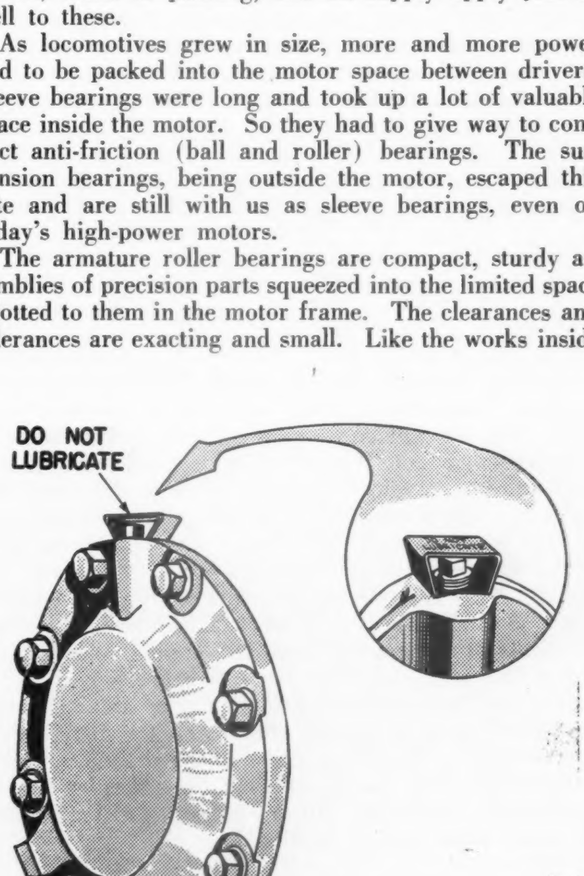


Fig. 2—Method of sealing bearing cap with pipe plug and seal

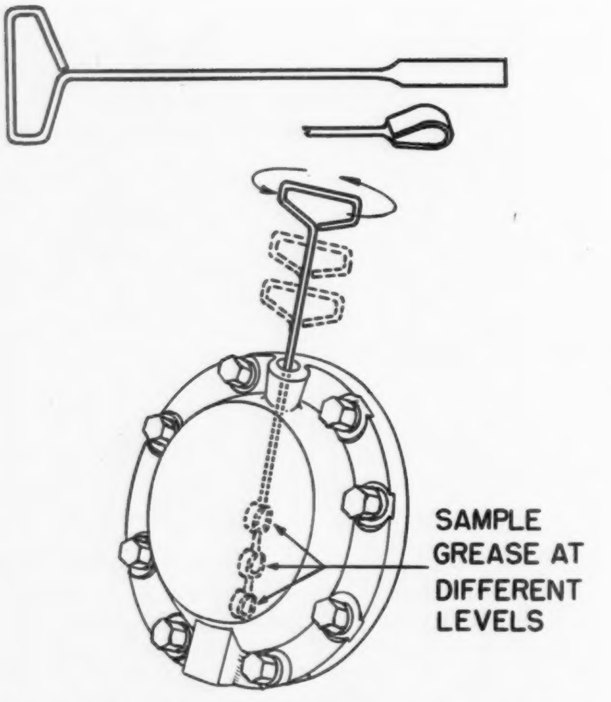


Fig. 3—A probe is a handy way of checking the grease in a bearing without removing the cap

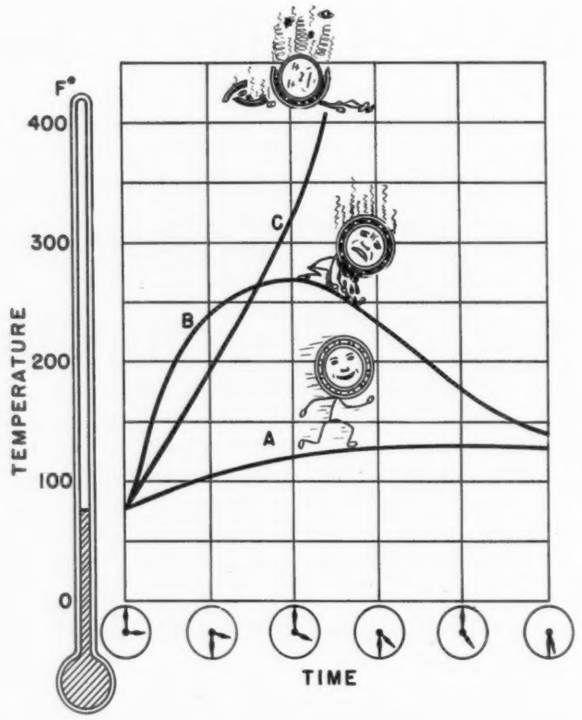


Fig. 4—Effect of greasing on bearing temperature

a watch case, these bearings are completely enclosed and protected. You can't get at them for inspection while the motor is in the truck.

Stop, Look and Listen

All this is rather baffling after dealing with the easy-going suspension bearing. But it's surprising how much you can tell about anti-friction bearings by stopping to look and listen. The welfare of their watch-like parts depends upon the protecting enclosures. Examine these as you would a watch case. Check the bearing caps for dents or bulges which may rub the spinning parts. See that bearing cap bolts are tight so they securely clamp and compress the gaskets. You can't afford to let oil bleed away from the limited lubrication space of these bearings. Defective gaskets, especially at drain or bolt holes, (Fig. 1) will let oil seep out. Examine the ends of bearing cap bolts for oil seepage along the threads. Neither can you afford to let water and dirt enter the bearings. Check lubrication fittings, plugs and pipes to see that they are tight and secure. A poorly clamped lubrication pipe will vibrate and wear the threaded connection. This allows water and dirt to seep in, or lubricant to seep out (Fig. 1). Water and abrasive dirt mixed with grease form a good corrosive lapping compound—just exactly what you don't want in a bearing.

All your care and fine work can go for nothing if the lubrication guns or grease containers are dirty, or if a grease gun is attached to dirty, unwiped fittings. Keep a sharp eye open for good shop housekeeping where bearings are concerned. All this takes just a glance when you know what you are looking for.

Sealed Bearings

After careful research, sealed bearing lubrication was introduced for railway motor armature bearings. Such bearings run the whole time between overhauls without need for lubrication service. The bearing compartments are packed with just the right amount of a carefully selected high-stability grease when the motor is assembled. The grease used must be checked by laboratory methods to be sure it is right. It should be applied fresh to bearings completely cleaned of old grease. This is a job for the service or back shop. The bearing compartments are then sealed shut. Grease fittings are replaced with pipe plugs. These are tack welded to make a man pause and think before removing them. As a further precaution, warning plates reading, "Do Not Lubricate," (Fig. 2), may be welded over these plugs before the motors are placed in service.

Actually, harm may result if such bearings are tampered with between overhauls. Breaking the seal and adding too much grease or the wrong kind of grease has been known to cause bearing failures. This can easily happen to you, so watch the pipe plugs and seals.

Because of the many advantages of sealed bearings, their use has spread rapidly from new equipments to the conversion of existing motive power on many railroads. Now they are used, not only on traction motor armature bearings, but also on the bearings of auxiliary apparatus in the locomotive cab. And why not? Grease pipes and fittings are eliminated. You don't have to keep lubrication schedules for these bearings, so another maintenance chore is scratched from the list.

Still, Keep Your Eye Open

When making your inspection, don't overlook bearing enclosures just because they have sealed-in lubrication. Bolts can still come loose and gaskets can leak. See that the plugs and warning plates are intact. A broken weld on a plug may mean that someone has tampered with the bearing after the back shop boys had checked, greased and sealed it. Perhaps some maintainer, not informed on sealed bearing practice, was determined to do his job. A mere tack weld or seal on a grease plug will not stop such an eager beaver. Out comes the plug and in goes

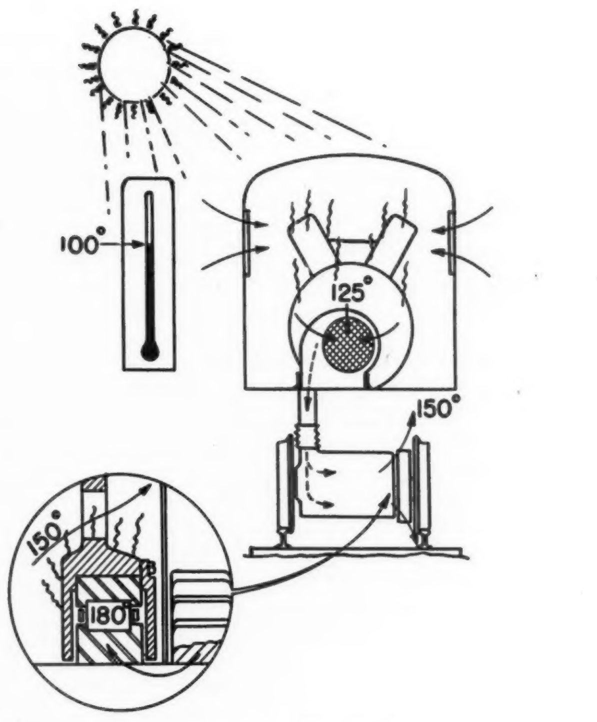


Fig. 5—Why the pinion-end armature bearing operates at high temperatures

the unwanted shot of grease. It's a lucky bearing that has a maintainer alert enough to spot the broken seal or weld. The next thing is to know what to do about it. It's the uncertainty that gets you. What did the other fellow do after he broke the seal? Maybe someone told him to put the plug back and no harm was done. Then again, maybe he added some wrong grease and spoiled the long-duty grease in the bearing.

Try a Little Probing

What to do now? Should the motor be dropped out of the truck and the bearing cap removed for a look inside the suspected bearing? Before you do that, you might probe out a sample of the grease from the bearing compartment. If you intend to do this, be sure to clean up around the loosened plug before you remove it. A probe can easily be made from a piece of soft iron wire. Hammer one end flat and curl it into a loop of such size as to pass through the plug hole (Fig. 3). Push it through the hole into the grease. Give the probe a turn and pull it out. Examine the sample caught in the hollow of the wire loop. Take samples from several levels in the cap. Look for any changes in color or texture between samples that might show that fresh or different grease had been added. If the grease looks uniform, soft and oily you might want to let the bearing run for a few more trips, and check it again later. Remember that a long-duty, high-stability grease changes gradually in service. If, however, it has been spoiled, it will change for the worse much faster. So, if you suspect the bearing has been tampered with, be sure to repeat the test soon.

Suppose the samples probed out show that the grease is already black, stiff and dry. Then there is no choice left but to pull the motor out of service. After that it is a job for the back shop gang to take apart, clean, grease and again seal the bearings. This is a much happier ending than to have a road failure and all that goes with it.

It Pays to Know

Even if you do not operate bearings with sealed lubrication, the method of probing for grease samples is still good. It is an easy way to keep your finger on the plse of your lubrication schedules. Suppose a few random checks show low quantities of dark, stiff, dry grease in the bearing compartments. This would justify removing some bearing caps for a better look. If the condition is general, the lubrication schedule may have to be stepped up. But first be sure that existing schedules are being properly maintained. See that guns deliver the required amount of

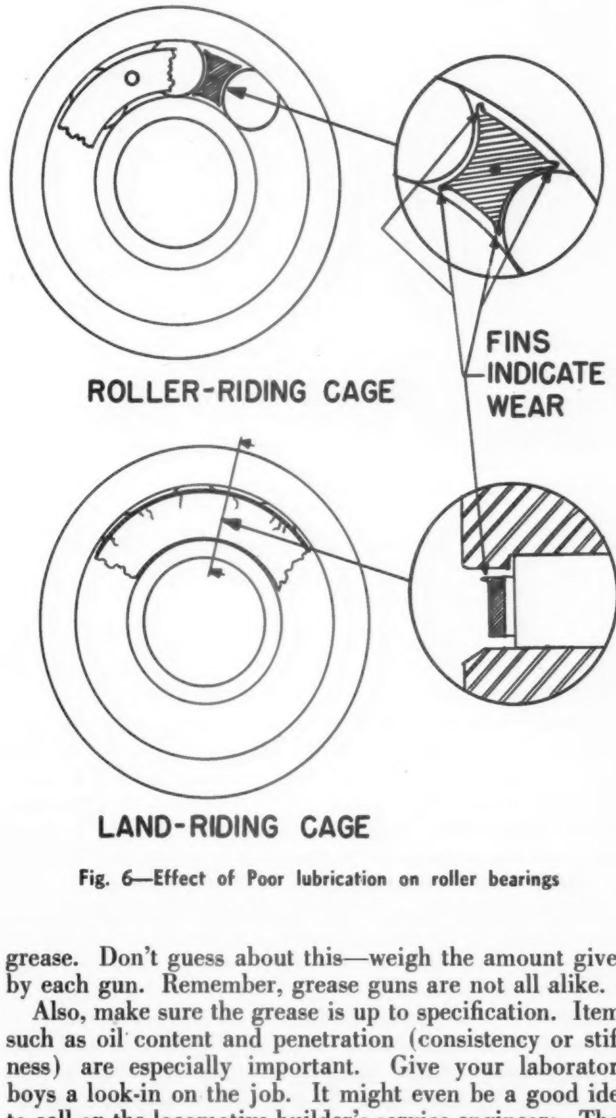


Fig. 6—Effect of Poor lubrication on roller bearings

grease. Don't guess about this—weigh the amount given by each gun. Remember, grease guns are not all alike.

Also, make sure the grease is up to specification. Items such as oil content and penetration (consistency or stiffness) are especially important. Give your laboratory boys a look-in on the job. It might even be a good idea to call on the locomotive builder's service engineers. They may have run into the same kind of problems elsewhere and have some answers.

Then, again, these random checks may show too much grease—or overfilling—so that the bearing housings and drains are plugged full. The overflow of excess grease may work into the motor. This is especially bad if it occurs at the commutator end. Here it may plug air passages or mess up brush contact and insulation. Furthermore, oil spread through the motor may support a damaging fire following a flashover.

Another way to keep track of what's going on is to get reports from the shops where the equipment is overhauled. When motors are torn down, the general condition and quantity of grease can be readily checked.

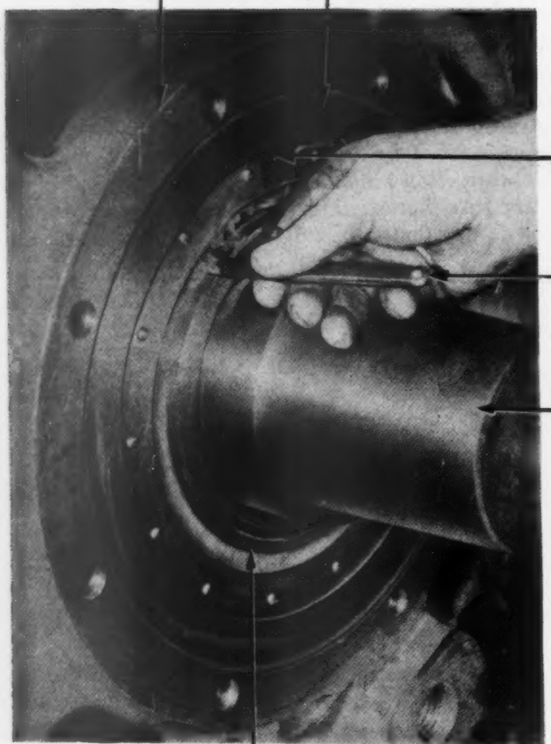


Fig. 7—Use of feelers to check clearance in roller bearing

Then you know the facts and can change lubrication schedules if necessary. You may even be able to track down trouble before it gets to a serious stage.

Such things as operating speed and temperature have much to do with the life of the lubricant. Sustained high speed combined with high temperature breaks down a lubricant faster than usual. High engine room temperatures, faulty blowers and dry gearing all help to raise traction-motor bearing temperatures. Keep these factors in mind when looking for causes of trouble.

Locomotive builders have studied the lubrication problem carefully. Their instructions cover a wide range of general service conditions. Operation in extreme temperatures may require adjustment of the schedule, or even a change in the kind of lubricant used. For instance, extreme cold may freeze regular grease and lock the bearing cage. Then the inner races will skid on the rollers and damage them. But as a rule, builder's recommendations should not be taken lightly. You will be stretching your luck if you jump from one lubricant to another without thorough study and tests. It is something you can't do by guess and by gosh. If there is a big change in your operating conditions, or you want to switch to what you think is a better grease—make tests first. There's always room for improvement in any operation, but be sure of your ground as you go.

What Tests Show

Look at the chart (Fig. 4) which shows results of tests. It will help make this business of bearing lubrication clearer. In curve *A*, you see how a properly lubricated bearing acts when running at full speed. The temperature gradually rises. Heat flows from the warmer bearing to the cooler air around it just as water flows from a higher to a lower level. After some 80 minutes, the bearing temperature levels off at about 30 deg. F. above the surrounding air. Now heat is flowing to the air as fast as it is being generated in the bearing.

From this example, you can see the connection between things as far apart as engine room temperature and traction motor bearing temperature. For instance, take a hot summer day with the outside air at 100 deg. F. Because of the heat given off by the power plant, steam generator, etc., the engine room temperature could easily reach 125 deg. F. (Fig. 5). This air is then blown through the traction motor to cool its working parts. Here it will pick up something like another 25 deg., so it is at 150 deg. F. when it blows over the pinion end bearing. This bearing must climb about 30 deg. higher to get rid of its own heat. Hence, it operates at 180 deg. F.—almost as hot as scalding water. No wonder we are tempted by high-temperature lubricants.

But wait—there is another angle to the problem. See what happens when too much grease is pumped into a bearing. Instead of a nice easy rise, the bearing temperature skyrockets (curves *B* and *C*, Fig. 4). Inside of *half an hour, it has shot away above the hottest day* operating mark, and is headed for the roof. If the grease used melts at this point, the excess will squirt through the running clearance of the bearing seals. This will ease the grease pressure in the bearing and the temperature will drop to about normal (curve *B*, Fig. 4). Of course, such an experience doesn't do the grease any good. In fact, its life has been shortened. But the danger of bearing failure has been averted. Need anything more be said about the importance of keeping a schedule and knowing how much grease is added?

Now suppose the grease used is such that it doesn't melt at this high temperature. The excess cannot escape to relieve the pressure. As a result, the temperature keeps going up (curve *C*, Fig. 4) until the bearing fails. Such a grease has been known to wreck a bearing without harming itself. Since there is always the possibility of over-greasing, it is best to avoid high-temperature greases which have a high melting point.

The use of oil for lubrication gets away from some of the troubles encountered with grease. But the space in a traction motor for carrying oil is very limited and oil escapes quickly if even a small leak gives it half a chance. Gaskets, bolts and plugs must be oiltight, or the oil will be gone before you finish a trip. Also, it is churned and used up during operation, so the bearing must be regularly refilled, and any overflow carefully cleaned up.

Performance Is the Real Test

After all is said and done, the proof of a lubricant is in its performance under operating conditions. Even after the tests just described, you will want to check the lubricant in actual service. The problem is to reduce the risk of failure while you are doing this. One way is to put out several motors with the lubricant on a test basis. Remove grease fittings and put plugs in their place. Seal these with metal tags reading, "Test—Do Not Lubricate." Notify all service points about these motors. This reduces the chances of someone upsetting the test. Keep track of the mileage, lubrication schedule, and exact amount added to each bearing—unless it is a sealed bearing scheme. It's a good idea to make one person responsible for this record.

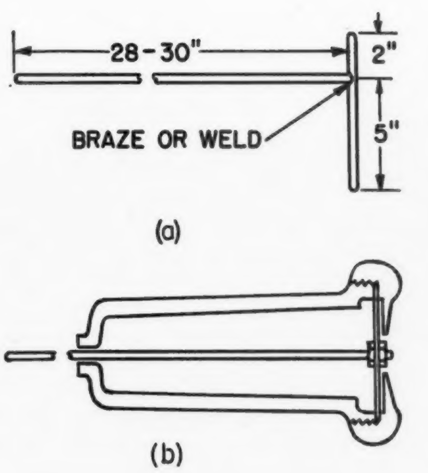


Fig. 8—Two types of listening rods that are easy to make

Fig. 9—Correct method of using listening rod on traction-motor bearing

Arrange to remove one motor at a time from service for a check-up. This may be at or between wheel change-outs. Remove the bearing caps to check the amount of grease in each bearing. The commutator-end bearing may behave quite differently from the pinion-end bearing. Don't take chances, look at both. Check the quantity of grease to tell if you must add more or less at each lubrication. Also, see how well the grease is lubricating the bearing. The races and rollers should be oily. If not, they may smear. This occurs when dry roller edges rub the flange of the bearing race like a tire rubs against a curb. The roller cage, or retainer, is usually the first to show wear if lubrication is scant. Look for dragged out feather edges on the roller pockets of a roller-riding cage (Fig. 6). A land-riding cage will show mushrooming and cracks along its outer circumference (Fig. 6). See if there are any signs of overheating and worn particles of cage material present in the bearing. While the bearing cap is off, measure the space between the unloaded rollers and race at the top of the bearing with feelers (Fig. 7). Check this clearance against recommendations. Remember, railway type bearings have clearance when assembled. This is needed to take care of expansion with temperature differences between the inner and outer parts. Sometimes, when bearings are enclosed, attempts are made to find the clearance by lifting the shaft and measuring the movement with an indicator. This is hard to do; but if you try it, be careful not to lunge on the shaft, or you may disturb the indicator enough to give a false reading. Lift the shaft slowly with a jack. If anything serious is found on one bearing, take action on the other test motors right away.

Above all, be careful to keep dirt out of the open bearing assembly when making the inspection. Remember, the bearing is like an open watch. Clean the entire end of the motor before you take off the bearing cap. When you remove it, be sure you are out of the wind so that dirt doesn't blow or fall in. When you close up the job for return to service, see that gaskets and lock-washers are fit for use. You don't want that little puddle of oil that collects in the bottom of the bearing compartment to ooze away. If it does, it may bleed the grease dry. When the next inspection comes up look at another motor, and so on. Continue the test until you are sure of the results.

While this test is easy enough to run, it does take a long while before you know whether the change is safe for your entire fleet. With somewhat more risk, the changeover could be started after the first or second inspection showed all to be well with the test motors. The test should go on, however, with regular checks, for the full time. Then, if trouble does develop, you have some lead time to head it off before it affects the fleet.

Make the Most Of Your Opportunities

Whenever a motor is out of a truck, you have an opportunity to listen to the bearings. Don't pass it up. Bearing failures in service have been averted by taking just a little time to listen to them run before the motor was trucked. Then you can hear the smooth whirr of a healthy bearing, or the grinding crunch or click which spells trouble. Let the motor go through its speed range while you listen.

A regular doctor's stethescope, or one of the electronic devices now available will aid your hearing. But it is surprising how well you can hear these sounds with a simple listening rod (Fig. 8 a). Hold it against the bearing cap, with the other end just a little ahead of the ear on the soft part over the passage to the ear drum (Fig. 9). Experiment until you find what suits you best. Another convenient listening device can be made from an old telephone receiver (Fig. 8 b). Attach the end of a light rod to the diaphragm. Let the other end project through the shell far enough to easily reach the motor.

Now you are ready to practice listening for noisy bearings. It takes only a moment after you have become accustomed to it. And that moment may avoid a mess of smashed machinery. This is preventive maintenance at its best. Even though armature bearings are hidden, inaccessible and completely enclosed, they talk. When you know the language, it is amazing how much you can learn if you just stop to look and listen.

Eliminating Wrong-Voltage Hazards

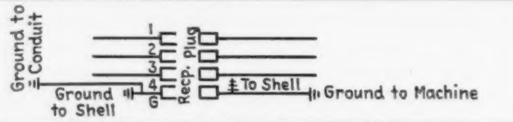
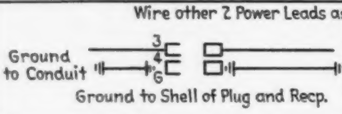
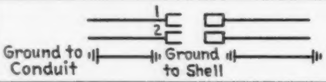
By David H. Noble

Plugging a 110- or 220-volt hand tool into a 440-volt receptacle can have disastrous results, not only to the tool, but to the operator as well. Yet, unless preventive action is taken, it can easily occur even in the best run shop.

The most positive cure is to select a standard, non-interchangeable receptacle for each class of electric service. Sizes and styles of receptacles can be determined by service requirements and voltage. Thus, heavy duty convenience outlets or, preferably, twist-lock receptacles could be standard for 110-volt portable lights, while those for 440-volt service should be capable of carrying the high currents of welding machines and similar apparatus, protected against accidental contact with a "hot" pole. All receptacles should have provision for a grounding conductor from the machine frame, and be properly polarized so that the plug cannot be inserted improperly. High voltage receptacles should be of the circuit breaker type in which an interlocked lid prevents plugging in the portable line until the breaker is placed in the *Off* position.

How one large railroad eliminated the hazards and problems of widely assorted receptacles is shown by the list of standard receptacles in the illustration. In order to permit a gradual change-over, instructions were issued that whenever extensive rewiring was required in a certain shop or area, the new standard receptacles were to be installed. In turn, old receptacles removed from these areas were to be used as replacements for effective receptacles in locations where the new standards were not yet installed. All electrical supervisors and shop storekeepers were furnished copies of the "Standard Shop Receptacles" drawings indicating type receptacles for each service, proper wiring, and ordering information. As a result, it was possible gradually to replace old receptacles in one area at a time without disrupting shop operations.

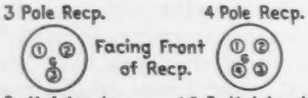
STANDARD SHOP RECEPTACLES AND PLUGS

VOLTAGE	PHASE	RECEPTACLE	PLUG	WIRING	
440 V.-A.C. Welding	3	Pyle National Circuit Breaker Pylet with Interlocked 60-Amp, 3 Wire, 4-Pole Quel-Arc Receptacle Circuit Bkr. to Suit Normal: Style CKJ-Hazardous Locations. VKJ	P.N. "JPD" Quel-Arc Plug 4-Pole, 60 Amp.	 Ground to Conduit; 1; 2; 3; 4; G; Recp.; Plug; Ground to Shell; To Shell; Ground to Machine	1
220 V.-A.C.	3	Pyle National AAR Std. Stand-By Recp.-3 Wire, 4 Pole, 100 Amp.	Pyle National AAR Std. Stand-By Plug. 3-Wire-4-Pole	Wire other 2 Power Leads as Above  Ground to Conduit; 3; 4; G; Ground to Shell of Plug and Recp.; Leave No.4 Pole on all Stand-By Plugs unwired; Ground to Shell of other Plug or to Equipment Frame	2
220 V.-A.C.	1	Crouse-Hinds RQH 302-2 Pole Recp.	Crouse Hinds RQ 302 Plug	 1; 2; Ground to Conduit; Ground to Shell; Ground to Machine	3
110 V.-A.C.	3	Pyle National "CR-" 3-Wire, 4-Pol. Recp.-Style "J"-Spring Cover	Pyle National "SP" 3-Wire 4-Pole Plug-Style "J"	Wire as shown in Line 1	4
110 V.-A.C.	1	Pyle National "CR-" 2 Wire, 3-Pole Recp.-Style "J"	Pyle National "SP" 2-Wire 3-Pole Plug-Style "J"	Ground as shown in Line 1-Wiring same except only 2 Power Leads	5
220 V.-D.C.		Crouse Hinds QE 6303 3-Pole Recp.	Crouse Hinds BP 533 3-Pole Plug	Ground as shown in Line 1	6
110 V.-D.C.		Crouse Hinds QE 6302 2-Pole Recp.	Crouse Hinds BP 532 2-Pole Plug	Ground as shown in Line 3	7
32 V.-D.C. Battery Charging		Pyle National AAR 150-Amp. Battery Charging Recp.	Pyle National BCPD Type Plug	Center Pole-Neg. Term. Outer Pole-Pos. Term.	8

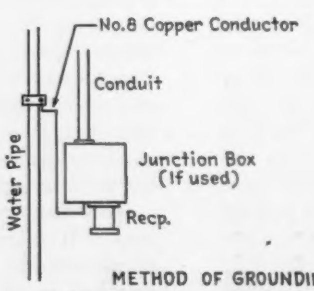
~NOTES~

1. All Recp. to be grounded as shown.
2. Ground Wire must be securely fastened to Plug Shell and when available, the extra Ground Pole, except with 3 ϕ, 220V (Stand-By) Plugs where the No. 4 Pole is to be left unwired.

~WIRING~



When grounded Neutral System is used the Neutral will be treated as a 'Hot' Lead and will not be connected to the Ground Pole.



METHOD OF GROUNDING

If no Water Pipe is available use ¾ In. Rod driven 8 Ft. or more into Ground. See Sect. 2582-2586 of Nat. Elec. Code.

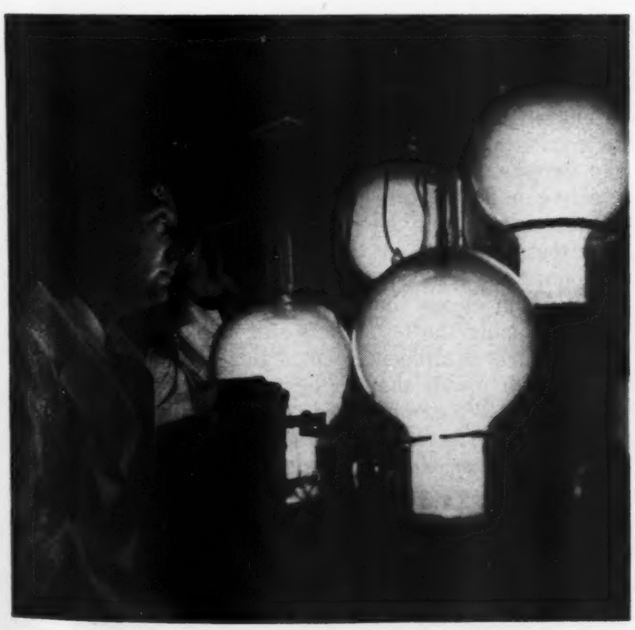
~REVISIONS~

A-35-Amp. P.N. Welding Recp. Replaced with 40-Amp.	10-31-50
B-General Revision	12-1-50
C-Wiring Detail Added	3-29-51

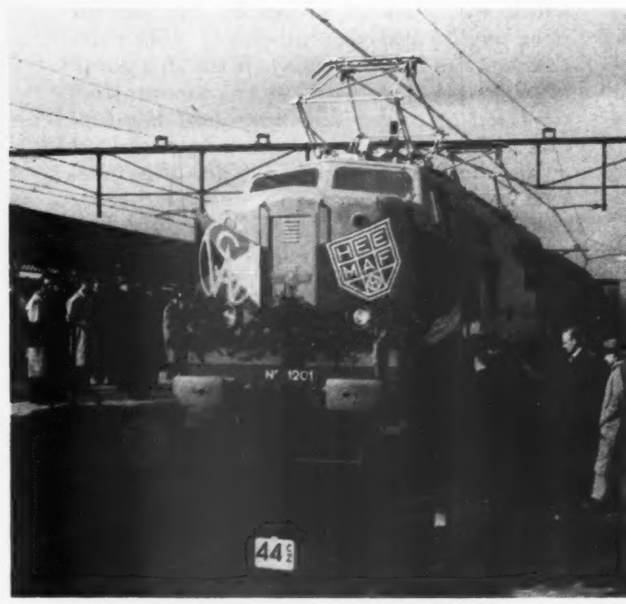
Original Ignitrons which have been in continuous service since 1936 were rated 25 amp.

Evolution of the Ignitron

Ever since the Ignitron mercury-arc rectifier principle was announced by Westinghouse in 1932, engineers have worked to make the Ignitron tube more efficient and reliable. Working with ignitors for the tube, Adolph Toepfer put some of the early Ignitrons on test in 1936 (left) to find out how long they would last. Fifteen years later, during which time the tubes have struck new arcs some 27 by 10^9 times and run up a power bill of over $4,000, the Ignitrons are still converting a.c. to d.c. With reduced anode voltage, and because some carbon has sputtered off the graphite anodes and darkened the glass envelopes, the tubes do not burn as brightly (right). Boron-carbide ignitors are still used in the latest Ignitrons, but a method has been devised of molding boron-carbide powder in a graphite mold, whereas the original ignitors were made by heating carbon to 2,000 deg. F. and converting boron-oxide to boron-carbide. The early Ignitrons pictured were rated 25 amp.; the new type WL-688 Ignitrons shown are rated 400 amp.



Recently developed Ignitrons using improved ignitors operate at a current density of 400 amp.



First of 25 electric locomotives being built at Dutch plants from American design shown at inaugural ceremonies at Hengelo, Netherlands, where the electrical installation was built. The units are scheduled for service on the Netherlands Railways to speed delivery of coal from the mines of Limburg to the industries of the west

U. S. Electric Locomotives In Holland

A fleet of 25 units of a new series of electric locomotives, which are the product of combined American and Dutch engineering skills, is being built by two Dutch companies, to American designs and with more than $1 million worth of American parts. Purchase of the parts was financied with the aid of the Economic Cooperation Administration (now the Mutual Security Agency) under the Marshall Plan.

The design of the electrical installation was provided by the Westinghouse Electric Corporation of Pittsburgh, Pa., while the mechanical design originated with the Baldwin Locomotive Works in Philadelphia, Pa. The new units have begun to move, at the rate of about three a month, from the assembly plants of the two Dutch firms, N. V. "Heemaf-Hengelo", in Hengelo, and Werkspoor, in Zuilen, into the Netherlands Railways system. The entire 25-unit fleet is expected to be on the rails by the end of July.

CONSULTING DEPARTMENT

Should A Ringer Contradict a Megger

We got a "Megger" instrument reading on a locomotive of 30,000,000 ohms (30 meg.) with a 500 -volt d.c. Megger. Then when we tried to hi-pot it, the circuit breaker kicked out at about 450 volts (across the hi-pot leads). With this same high megger reading on the locomotive, we tried an old bell ringer and the bell was quite loud. We measured the output of the bell ringer with a 1000-ohm per-volt voltmeter, and the voltage across the leads was only 100. Why would bell ringer ring so loudly when the resistance reading is so high? Is it true then that no matter how high the resistance is to ground, one is not sure the equipment will stand a high-potential test? This happened to us three different times on different locomotives. One time with a "Megger" instrument reading of 30, another of 20, and the third one of 15.

Hi-pot Breakdown May Make Path for Ringer

From the wording of the question, we understand that the sequence of events were:

1. The locomotive was meggered with a 500-volt Megger instrument indicated 30 meg.
2. The locomotive was then given a hi-potential test with a.c. hi-pot equipment and broke down at 450 volts.
3. After the breakdown the ground could be checked with a bell ringing set. There is no intimation in the question that the circuit was checked with the Megger after it broke down on hi-pot.

If this understanding of the sequence of events is correct, we can report having had similar experiences in that a locomotive which has been meggered may break down on hi-pot. The converse is also true that a locomotive may show a low insulation reading, but can pass the hi-potential test without difficulty.

I believe there is a satisfactory answer in the fact that higher voltage was applied to the locomotive by hi-potential test. The Megger instrument manufacturer's instruction book shows that with a 500-volt Megger measuring a 30 meg. resistance, the output of the Megger would be almost its full rated 500 volts, or about 495 volts d.c. The voltmeter used with an a.c. hi-potential testing equipment reads the effective value of the sine wave of voltage. In order to obtain the peak voltage of the sine wave, this effective value must be multiplied by the square root of 2, or 1.41. Therefore, when 450 volts a.c. was applied to the equipment, the peak voltage of this wave was 637 volts, which is materially higher than the Megger voltage. Our assumption would be that this higher voltage caused a breakdown across some small gap or series of gaps. The follow-up current from the hi-pot set then carbonized a solid conducting path resulting in low resistance to ground.

If the above assumptions are correct, it may be assumed that the Megger was giving a true indication. The hi-pot test by actually applying a higher voltage broke something down, and changed the circuit from high resistance to low resistance to ground. The bell ringer was then able to operate on this low resistance.

J. D. Alrich
General Electric Company
Erie, Pa.

Capacitance May Cause Ringer to Operate

The background information given to support the questions is not complete, so certain assumptions will have to be made in our answer.

The first question involves the use of a so-called bell ringer to check the 30-megohm resistance measurement. We think this means that an old-fashioned hand-cranked magneto was used having an a.c. output. This being so, the bell would undoubtedly ring as a result of the capacitance involved in the circuit, regardless of the amount of d.c. resistance in parallel with the capacitance. In other words, depending upon the amount of capacitance involved, and the magneto output frequency and voltage resulting from cranking speed, the results are not at all surprising.

The fact that this circuit broke down at a relatively low voltage after indicating a resistance of 30 megohms is more difficult to explain, and we cannot help but question the information given. We know, of course, that high insulation resistance does not in itself guarantee that a dielectric can withstand an over-voltage, since a clean gap or puncture can be in parallel with the resistance which can flash over through the gas (air) involved. However, to do this the voltage must be somewhat higher than that produced by the "Megger" instrument. At 30 megohms, the regulation of any "Megger" instrument is good, which means that very close to 500 volts d.c. was applied during the test. It is safe to say that the high-potential test equipment used in this case was of the a.c. type, which means that if the voltmeter with which the 450 volts was measured was of the moving-iron type, it measured the r.m.s. value of the voltage and not its peak. The peak value of 450 volts r.m.s. is about 655 volts. Furthermore, when applying an a.c. high-potential test, the test connections should be made in such a manner that no arcing results with consequent high-voltage transients or oscillations. The actual time duration of the application of the a.c. high-potential test is also a factor which must be considered when comparing the relative breakdown strength of insulating materials or gaps.

R. M. Springer

EDITORIALS

Where Do We Go From Here?

Steam locomotives for a hundred years and then diesels. Diesels at first slowly, and then rapidly pushing steam off the reservation. And how long will it take before there are no more steam locomotives—well, practically none? Some look forward to complete dieselization by 1960, and some think it will take five years longer. Few seem to doubt the ultimate outcome.

But there are a few never-say-dies who challenge the diesel aggressor. Among these are those who are working on the gas-turbine-electric locomotive. Much development work has been done; the Union Pacific has put an experimental locomotive through its paces, and now is putting improved types into regular revenue service. Speaking at a meeting of the New York Railroad Club on March 20, 1952, W. A. Brecht, Manager, Transportation Engineering Department, Westinghouse Electric Corporation, told of the operation of the Westinghouse experimental locomotive. It has, he said, been making daily round trips on the Pennsylvania between Harrisburg, Pa., and Altoona, Pa., for a month without a single detention. It has been hauling 29-car trains in express service, burning Bunker C oil.

Many say it would have been nice if the gas-turbine could have been developed sooner to give the diesel more competition. But that is just wishful thinking. By the same token, it would have been nice if we could have had diesels in the 1830's when the steam locomotive was being developed. Even though we have diesel saturation, the gas-turbine can still become a strong competitor. Perhaps, too, the gas-turbine can be taught to burn coal.

Then there is the steam-electric locomotive with high-pressure, 600-lb. per sq. in. boiler which will probably be delivered to the Norfolk & Western about the end of this year. Mr. Brecht stated that this unit, which burns coal, will have a thermal efficiency about double that of the conventional steam reciprocating locomotive.

Always for the diesel there is the specter of straight electrification. Ideal insofar as operation of trains is concerned, but constrained now in this country by high first costs which require long periods of years for amortization. The diesel may be purchased on a pay-as-you-go basis, and with present fuel-oil costs to help the diesel, and insufficient traffic density to warrant the first cost of electrification, the only present market for electric locomotives is on those roads with existing electrified lines. However, should the price of oil increase considerably, electrification might become more attractive, and the manufacturers are ready with new types of electric locomotives to help it along. Mr. Brecht referred to performance of one of these on the Pennsylvania. It, the rectifier locomotive, rated 6,000 hp. hauled a train of 162 loaded coal cars—almost a mile and a quarter long—from Enola Yards, near Harrisburg, Pa., to Morrisville, Pa., at an average speed of 30 m.p.h. over the 130-mile route. This is more than 400,000 gross ton miles per train hour.

Always the research and development departments of our supply companies are breaking their necks to produce new things, and by so doing put their own production departments out of business. Then the production men have to change their dies, their methods, the materials they use, etc. But, under our system of free enterprise, the whole company would go out of business if this were not so. Other companies would produce better equipment and get the business. Anyone who thinks our railway supply industry isn't on its toes should take another look.

Freight Car Conditions in Interchange

An analysis of freight-car conditions prevalent at the great Chicago gateway during 1951, as reported by the Chicago Car Interchange Bureau, affords reasons for encouragement at progress being made and at the same time points unerringly to elements of weakness. As a matter of fact, out of a total of ten statistical tabulations reflecting car conditions and handling in interchange during 1951, as compared with 1950, only four showed improvement to six which indicated poorer performance.

On the credit side of the ledger, first mention should be made of the reduction in cars shopped for old defects. With a total of 4,267,626 cars interchanged at Chicago in 1951, or 118,303 more than in 1950, only one loaded car in each 177 delivered had to be shopped by the receiving carrier for repairs, compared with 1 in 165 cars delivered in 1950. The adjustment of loads in closed box cars dropped from 186 to 94.

Loaded hopper and gondola cars interchanged with partly open doors were reduced from 212 to 162 and the estimated tons of lading lost, from 2,083 to 1,880. Cars with perishable freight loads, shopped for repairs but reaching destination as intended, included 2,084 of the 2,155 cars repaired. Or, put in another way, only one of each 6,060 perishable loads delivered in 1951 failed to reach destination on schedule, as compared with 1 in 111 cars in 1930 when the campaign to cut perishable load delays was first started.

As always, further intensive work is in order and in fact essential to minimize the transfer of loads in interchange freight cars. At Chicago, for example, the number of cars transferred, increased from 1 in 17,808 cars in 1950 to 1 in 13,463 cars in 1951, thus reflecting the failure of originating carriers to exercise sufficient care in furnishing cars mechanically fit to carry loads to destina-

tion. The resultant increased operating expense and cost of load transfers are both charges against railroads on which these loads originate.

Some of the other conditions especially in need of improvement are suggested by the following figures: Cars interchanged at Chicago and found not loaded in accordance with A.A.R. rules increased from 190 in 1950 to 412 in 1951; cars with shifted loads, from 11,073 to 11,720; bad order and unclean cars, from 1,390 to 1,616; empty hopper and gondola cars with improperly secured drop doors, from 3,382 to 4,802; pairs of wheels changed on account of cut journals, from 9,513 to 12,716.

Plainly, there is plenty of work still urgently in need of being done to improve railway freight car conditions and use. An adequate supply of new cars to replace the worst of the present inventory would be a great help.

Working Instruction

Just about everyone will agree that a mechanic being trained for diesel locomotive work will learn more about handling maintenance if along with the explanation of the parts and their functions he is given opportunity actually to perform the maintenance operations himself. This working instruction, or participating instruction, coupled with lectures and discussions is superior in educational value to the lectures and discussions alone for two principal reasons.

When more senses can be brought into play in the learning process, more can be learned and a greater portion of what is learned is retained. Participating instruction further affords the student diesel mechanic a chance to find out what he missed in the more formal phases of the instruction. It is not uncommon for a man to think that he can handle a job after being shown or told how to do it; yet when he is on his own to do the work he finds that he gets stuck somewhere in the procedure. When participating instruction follows classroom instruction the student can have his troubles straightened out on the spot.

The value of affording participating instructions is recognized in recently built diesel instruction cars in two different ways. One is apparent, the other not so apparent. Some cars have engine sections and provisions for dismantling and assembling the engine and the individual engine parts. On others the space and money available have been devoted to studying operating features and the causes of failures for greater emphasis on trouble shooting. Railroads that follow the latter practice feel that where participating instruction is desirable it can be given more effectively on an actual locomotive.

Time and experience will show which procedure is best under what circumstances. A major factor is whether the car will be used to teach men before the locomotives arrive on a newly dieselized division, or whether the car will follow the arrival of the locomotives; only in the latter event will the locomotives be available for participating instruction. The phase of diesel instruction to be emphasized, trouble shooting or maintenance, should play an important role in laying out any new instruction car. So too should be the method of giving participating instruction if this valuable tool in teaching diesel maintenance and operation is to achieve maximum effectiveness.

New Books

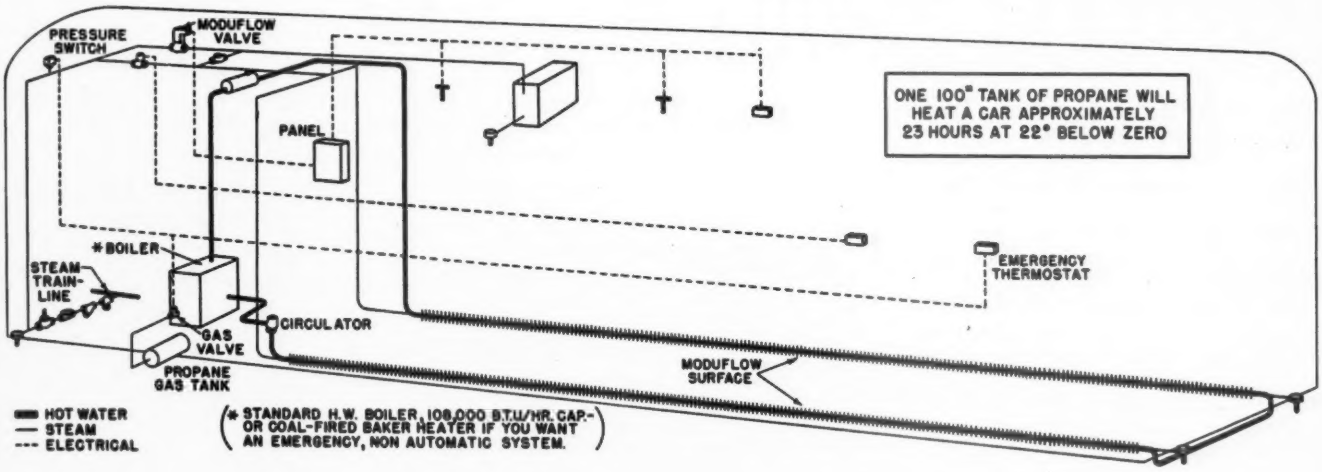
ENGINEERS' ILLUSTRATED THESAURUS. *By Herbert Herkimer. Published by the Chemical Publishing Company, 212 Fifth avenue, New York 10. 572 pages, 5½ in. by 8 in. Price, $6.*

The purpose of this book is to emphasize the underlying principles of machine elements and assembled machinery, not structural details such as would appear in a textbook of machine design. Machine parts and their movement are classified in a manner similar to that of Roget's Thesaurus of English Words and Phrases in which a word is classed according to the idea it intends to convey. Each class is divided into sections, and each section is further subdivided into topics, illustrated by drawings or photographs. Descriptive text is kept to a minimum, an explanation of the method by which an element accomplishes its particular function being given only where necessary. Illustrations, totaling over 8,000, include assembly drawings typical of American and foreign designs. Among the principal classes treated in the book are fasteners; adjusting devices; supports and structures; basic mechanical movements; combustion; prime movers; transportation; electrical appliances; comfort heating, cooling and air conditioning, etc.

MAKING, SHAPING AND TREATING OF STEEL. *Sixth Edition. Published by the United States Steel Company, 525 William Penn Place, Pittsburgh 30. 1,435 pages, illustrated. Price, $7.50; to schools and colleges, $5.*

This edition is a complete revision based on the original text by J. M. Camp and C. B. Francis. The information contained in its 38 chapters is a compilation of past and present practices in the iron and steel industry based upon the practical experience of the many experts and authorities in each steel-making field who cooperated in the preparation of the book. Each chapter is made as nearly independent of the others as possible and is subdivided into sections. The chapter on the principles of heat treatment of steel includes the work of Bain, Davenport, Grossmann and others who have helped to reduce the art of heat treatment to a science, with changes in steel structure predictable by comparatively simple diagrams. Similarly, understanding of thermo-dynamics, heat flow and ceramics has been broadened by Dr. J. B. Austin and his associates at U.S. Steel's Kearny Research Laboratory. Other subjects completely revised and expanded to cover new methods and techniques developed in the past decade include Fundamental Principles of Chemistry and Physics; Refractories; Manufacture of Pig Iron; The Bessemer Process; The Open-Hearth Process; Manufacture of Steel in Electric Furnaces; Steel and Iron Castings; Manufacture of Hot-Strip Mill Products; Manufacture of Cold-Reduced, Flat-Rolled Products; all chapters on various grades of steel; Mechanical testing, etc. The index contains more than 23,000 listings.

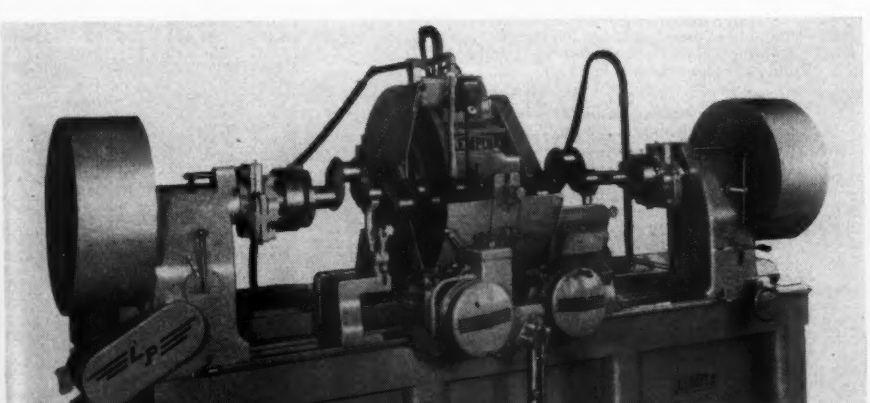
NEW DEVICES



Emergency Heat for Passenger Cars

A means for heating passenger cars when the locomotive runs out of water or when batteries fail has been developed by the Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. It may also be used when a car is not in a train, when it is desirable to use a freight locomotive to haul a passenger train or during long periods when the cars have to be switched.

The device used is a modification of the regular Minneapolis-Honeywell heating system. It consists of a propane gasfired hot water boiler, controlled by a valve and thermostat, which get their power requirements from the pilot flame. No steam or electric energy are needed. The closed water loop which normally supplies floor heat is run through the gasfired boiler at one end of the car. A pressure switch starts the boiler automatically whenever the steam pressure on the regular system falls below a pressure of about two pounds. The design of the equipment is such that it may be adapted to cars that are now in service.



Hydraulic Traverse Crankshaft Regrinder

A newly designed type RCG crankshaft regrinder which transfers the burden of accuracy from the operator to the machine has been made available by Lempco Products, Inc., Bedford, Ohio.

The grinding wheel can be slowly power-fed, through hydraulic controls across the bearing surface. In-feed and retraction of grinding wheel is also accomplished hydraulically in ½ second without cranking. Its shaft is balanced within ounces on a direct-reading scale without interfering with swing or stroke.

This unit has capacities up to 137 in. shaft, depending on the model, important on the new and larger shafts used in diesel work. Among its features are a 360 deg. graduated throwhead that enables the operator to move from one set of throws to another in one set up.

Three grinders are available in 89, 125 or 137 in. capacities, with stroke up to 14 in.

◆

Fuel Oil Heater Cleaning Compound

A cleaner for removing carbonaceous deposits from the tubes of fuel oil heaters without dismantling the equipment has been introduced by the Magnus Chemical Co., Garwood, N. J. These deposits are simply exposed to the action of the Chemical compound.

Experience of a power plant for a western railroad indicate the following method has proven successful

An empty 55-gal. drum was equipped with a reversible flow gear-type pump, motor-driven and piped, with a capacity of 3-gal. per min. All valves on the fuel oil lines to the heater were closed and oil in the unit drained. A pipe was connected from the drum to the inlet port of the exchanger. Its outlet port was in turn connected to a return line to the drum, equipped with a screen to retain loosened carbon deposits.

A solution of one part by volume of

(Continued on page 144)

NEWS

More Material Allocated for Equipment

INCREASED allotments of controlled material for second-quarter production of freight cars and locomotives have been announced by the Defense Production Administration.

The increases allocated to the National Production Authority's Railroad Equipment Division material for the production of an additional 3,000 freight cars during the second quarter. Since previous allocations contemplated a second-quarter production of 18,000 cars, the quarter's program has now been put on a 7,000-cars-per month basis.

The D.P.A. announcement also said that car builders had been given permission to build up to 4,000 (instead of 3,000) additional cars, if this can be done "by stretching materials through conservation measures and use of inventory."

As for locomotives, the increased allotments are expected to raise the second quarter's production by 100 engines—from 700 to 800. And the industry will be permitted to build 50 more if it can stretch its allotments that far.

Administrator James K. Knudson has filed with D.P.A. a presentation seeking materials for production in this year's third quarter of 30,000 freight cars (other than tank cars), 2,550 tank cars, 100 passenger-train cars and 975 locomotives.

Since Mr. Knudson's presentation, the N.P.A. has announced that locomotive builders has accepted a "tentative formula," offered by N.P.A., "which would be used to govern unit output and the distribution of controlled materials starting in the third quarter." The formula has been approved by N.P.A.'s Locomotive Builders Industry Advisory Committee, the announcement also said.

It went on to explain that the formula "totals production of diesel-electric locomotives of all sizes in the proposed three-year base period (1948-1950) and permits each builder to produce locomotives according to his percentage of industry's total unit output in that period." At the present time, locomotive builders are allocated materials on the basis of their own individual production in the 1948-50 period.

Taking into account the output of diesels for United States railroads, and for industrial, export and Army use, N.P.A.'s Railroad Equipment Division compiled the following "tentative" table showing production by each builder in the base period, and each builder's proposed percentage of permitted output.

As N.P.A. reported proceeding of a closed meeting held during March of the advisory committee, the group recommended that the Defense Production Administration, in allocating materials, arrange to handle military requirements separately from those for commercial-type locomotives. The committee also recommended that the military orders be given

(Continued on page 118)

TABLE SHOWING TENTATIVE PRODUCTION BY BUILDERS OF DIESEL-ELECTRIC LOCOMOTIVES DURING THREE-YEAR BASE PERIOD (1948-1950)

Builder	Total Production 1948—1949—1950	Percentage
American Locomotive Company	2,228	21.7
Baldwin-Lima-Hamilton Corporation	1,220	11.9
Electro-Motive Division, General Motors Corporation	5,283	51.4
Fairbanks, Morse & Co.	372	3.6
Davenport Besler Corporation	109	1.1
General Electric Company	800	7.8
Plymouth Locomotive Works	5	0.04
Vulcan Iron Works	7	0.06
Whitcomb Locomotive Works	247	2.4

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

Item No.		Month of November 1951	Month of November 1950	11 months ended with November 1951	11 months ended with November 1950
	FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)				
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	22,211	29,011	274,432	317,821
3-06	Total, Diesel-electric	24,804	19,271	248,998	191,774
3-07	Total, electric	793	798	8,935	9,087
3-04	Total, locomotive-miles	47,809	49,089	532,387	518,749
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,699	1,696	19,017	17,924
4-06	Empty, total	917	868	9,722	9,327
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	39,715	48,415	482,835	530,458
6-02	Total in oil-burning steam locomotive trains	10,523	13,424	130,867	141,804
6-03	Total in Diesel-electric locomotive trains	68,652	53,928	696,246	543,808
6-04	Total in electric locomotive trains	2,124	2,158	24,428	24,229
6-06	Total in all trains	121,023	117,964	1,334,513	1,240,605
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.04	1.05
10-02	Loaded freight car-miles	39.20	38.40	39.60	38.60
10-03	Empty freight car-miles	21.20	19.70	20.30	20.10
10-04	Total freight car-miles (excluding caboose)	60.40	58.10	59.90	58.70
10-05	Gross ton-miles (excluding locomotive and tender)	2,794	2,673	2,781	2,672
10-06	Net ton-miles	1,310	1,242	1,305	1,223
12	Net ton-miles per loaded car-mile (M-211)	33.40	32.30	32.90	31.70
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	64.90	66.10	66.20	65.80
14	Averages per train hour (M-211):				
14-01	Train miles	17.10	16.70	16.90	16.90
14-02	Gross ton-miles (excluding locomotive and tender)	47,157	43,948	46,499	44,469
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	46.40	46.40	46.20	45.30
14-02	All	44.30	44.00	44.10	42.55
15	Average net ton-miles per freight car-day (000) (M-240)	962	941	961	880
17	Per cent of home cars of total freight cars on the line (M-240)	38.10	37.00	37.20	41.30
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	8,434	11,310	109,447	128,382
3-06	Diesel-electric	16,965	15,062	180,111	160,774
3-07	Electric	1,589	1,572	17,766	17,605
3-04	Total	26,988	27,945	307,325	306,762
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	265,404	269,256	2,997,852	2,955,677
4-09	Total in coal-burning steam locomotive trains	45,624	61,442	575,003	666,196
4-10	Total in oil-burning steam locomotive trains	28,489	34,474	355,661	403,440
4-11	Total in Diesel-electric locomotive trains	173,783	156,442	1,876,271	1,696,601
12	Total car-miles per train-miles	9.66	9.47	9.59	9.44
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,064	1,435	13,154	15,664
1-02	Steam, oil-burning	224	279	2,604	2,757
1-03	Diesel-electric[1]	3,084	2,752	32,557	27,591
1-06	Total	4,396	4,494	48,594	46,314
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	37	53	496	634
2-02	Steam, oil-burning	13	15	143	149
2-03	Diesel-electric[1]	245	237	2,665	2,515
2-06	Total	329	339	3,672	3,673
3	Hours per yard locomotive-day:				
3-01	Steam	7.70	8.80	7.80	8.10
3-02	Diesel-electric	17.20	18.10	17.20	17.50
3-05	Serviceable	14.60	14.80	14.40	14.20
3-06	All locomotives (serviceable, unserviceable and stored)	17.70	12.90	12.40	12.00
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.79	1.84	1.77	1.79
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.77	0.78	0.76	0.77

[1] Exclusive B and trailing A units.

more for your money
in a GM Diesel Locomotive

ADVANCED manufacturing methods are only part of the story, of course, but they do help to explain the extra values you find in General Motors Diesel locomotives.

Never-ending development of special-purpose machines, tools and techniques has enabled us not only to build these locomotives in large-scale volume, but to produce a constantly improving product as well. And the task is far from finished.

GM production engineers conduct a continuous search for easier and more efficient ways of doing every job — from the production of raw materials straight through the manufacture of all components to the finished locomotive. Because, as everyone knows, the easier you make it to do a job, the better the job you get.

Here you see a few specialized operations — typical of hundreds at Electro-Motive — where the economies of streamlined mass production are utilized to construct locomotives of top quality at the lowest possible cost.

10 PLUS FEATURES IN ELECTRO-MOTIVE'S LIFELONG SERVICE PROGRAM

1. **UNMATCHED EXPERIENCE** gained in designing, engineering and building more than 11,000 Diesel locomotive units.
2. **SUPERIOR MANUFACTURING FACILITIES** for mass-production of highest-quality locomotives at lowest cost.
3. **PROMPT PARTS SUPPLY** through strategically located factory branches and parts depots at eight key railroad centers.
4. **SKILLED TROUBLE-SHOOTING** and maintenance advisory service by a nationwide staff of 150 service engineers and parts specialists.
5. **FACTORY REBUILDING** of major assemblies with same techniques and tooling used in new manufacture.
6. **UNIT EXCHANGE SERVICE**—Prompt delivery of fully rebuilt assemblies in exchange for units needing rebuilding.
7. **PROPER SCHOOLING** of operating and maintenance personnel from the first day General Motors equipment goes on the line.
8. **SPECIAL ENGINEERING** of new and improved parts to make them fit General Motors units of any age.
9. **ONE-YEAR 100,000-MILE GUARANTEE** on Electro-Motive parts and rebuild effective upon installation, *not* the date of shipment.
10. **FACILITIES PLANNING SERVICE**—Expert assistance in helping railroads plan Diesel servicing and parts warehousing facilities.

ENERAL OTORS
LOCO OTIVES

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

La Grange, Illinois • Home of the Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ontario

preference; but that material for them should be allocated separately, and they should not be in the total over-all scheduling of railroad, industrial and export orders.

The committee was also reported to have urged that locomotive builders be given immediate (second-quarter) authority to make as many locomotives as possible from their allotments of materials, their inventories, and savings through conservation and substitution. Meanwhile, N.P.A. officials stated that they were studying the builders' third-quarter requirements; and the Railroad Equipment Division "is appealing for the programming of 1,212 locomotives in the third quarter as compared to the 850 authorized in the second quarter."

The N.P.A. statement went on to refer to "tentative" third-quarter allocations which would permit the production of only 800 locomotive units.

Railroads Set New High In Efficiency in 1951

American railroads operated with the greatest overall efficiency on record in 1951, according to year-end reports received by the Bureau of Reilway Economics of the Association of American Railroads.

Railroads not only moved more freight per train than ever before, but freight was transported at the highest average speed ever attained, the bureau said in a March 18 summary basd on these reports.

Class I roads moved an average of 21,767 net ton-miles per freight-train-hour in 1951, the highest average on record. This was approximately three times as great as the average for 1920 and approximately one-half above that for 1941. The average in 1951 also was an increase of 1,424 net ton-miles above the previous high record established in 1950, the bureau said.

Average speed of freight trains in 1951 also was greater than in any preceding year, amounting to 17 m.p.h. for all freight trains operated by Class I roads. This included the average speed of all freights, including locals as well as through trains, from terminal to terminal, and took into consideration all stops to add or remove cars, service stops and other delays occurring during that time.

This average was an increase of 65 per cent compared with 1920, and an increase of three per cent compared with 1941.

Class I carriers also handled an average of more freight cars per train in 1951 than ever before, the average in the past year having been 59.8 cars, compared with 35.6 cars in 1920 and 50.3 cars in 1941, the bureau continued. The average in 1950 was 58.5 cars per train.

A new high record in average speed of all passenger trains also was reached by Class I railroads in 1951. In that year, the average for all passenger trains between terminals, for both local and through trains, was 37.7 m.p.h., compared with 37.4 miles in 1950 and 36.1 miles in 1941.

ORDERS AND INQUIRIES FOR EQUIPMENT PLACED SINCE THE CLOSING OF THE MARCH ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Central of New Jersey	19	1,600	General utility	Alco-G. E.
	13	1,600	General utility	Electro-Motive
	4	1,200	General utility	Baldwin-Lima-Hamilton
	2	1,200	Yard switch	Electro-Motive
Manistique & Lake Superior	1[1]	600	Switcher	Alco-G. E.
New York Central	16A	1,600	..	Alco-G. E.
	8B	1,600		Alco-G. E.
Western Pacific	6	1,200	Switchers	Electro-Motive
	9	1,500	General purpose	Electro-Motive

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Carbon County	200	70-ton hopper	Greenville Steel Car
Chesapeake & Ohio	1,000[2]	70-ton hopper	American Car & Fdry.
Chicago, Milwaukee, St. Paul & Pacific	100[3]	Flat	Company shops
Delaware & Hudson	1[4]	246-ton flat	Company shops
Ft. Dodge, Des Moines & Southern	200	50-ton box	Pullman-Standard
Grand Trunk Western	6	Caboose	Internat'l Ry. Car & Equip.
Great Northern	100	70-ton covered hopper	Pullman-Standard
Minneapolis, St. Paul & Sault Ste. Marie	300	50-ton box	Company shops
	100	50-ton gondola	Company shops
Nashville, Chattanooga & St. Louis	400	50-ton hopper	Pullman-Standard
New York Central	600	70-ton covered hopper	Pullman-Standard
	500	50-ton box	Pullman-Standard
St. Louis-San Francisco	500	50-ton hopper	Pullman-Standard
Union Pacific	500	70-ton ore	Company shops
	600	70-ton gondola	Company shops
	500	50-ton box	Company shops
	500	50-ton auto-box	Company shops
Wabash	20[5]	Caboose	Company shops

PASSENGER-CAR INQUIRIES

Road	*No. of cars*	*Type of car*	*Builder*
New York, New Haven & Hartford	100	Coaches	
	100	Baggage	
	60	Multiple-unit	
Canadian National	47	Coaches	
	58	Bedroom-roomette	
	8	Buffet-lounge	
	6	Drawing-room-sleeping	
	10	Bedroom-dining-room-sleeping	
	5	Parlor-buffet	
	20	Tourist	
	20	Dining	
	15	Cafe-parlor	
	5	Parlor	

[1] Delivery expected in the fall.
[2] Authorization to purchase this equipment at an approximate cost of $6,000,000 was reported in the December issue.
[3] Depending on anticipated material deliveries, the road expects to build two of these skeleton log flat cars daily beginning in mid-April.
[4] Delivery expected in the third quarter of this year. Estimated cost, $36,000.
[5] Final delivery on the group expected this month. Estimated cost, $200,000.

NOTES:

Transportation Corps.—The Transportation Corps has cancelled, because of a major specification change, its call for bids on 135 40-ton refrigerator cars which was announced in the December issue.

Western Pacific.—The Western Pacific intends to place orders for 100 70-ton gondola cars and 100 70-ton ballast cars.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (Total)	Cars set off between division terminals account hot boxes: System	Foreign	Total	Miles per hot box car set off between division terminals
July 1950	2,745,932,894	....	....	23,957	114,619
August 1950	2,937,455,020	7,422	15,490	22,912	128,206
September 1950	2,974,297,739	6,541	12,881	19,422	153,141
October 1950	3,165,997,915	4,343	8,935	13,278	238,439
November 1950	2,868,871,913	2,536	5,331	7,867	364,672
December 1950	2,813,042,212	2,278	5,968	8,246	341,140
January 1951	2,840,847,511	2,870	8,436	11,306	251,269
February 1951	2,425,226,454	4,528	14,063	18,591	130,452
March 1951	3,063,173,942	3,667	10,078	13,745	222,857
April 1951	2,996,562,763	3,702	8,914	12,616	237,521
May 1951	3,013,634,782	5,631	13,737	19,368	155,599
June 1951	2,874,873,495	7,074	15,376	22,450	128,057
July 1951	2,768,920,095	8,886	18,823	27,709	99,929
August 1951	3,009,371,111	9,023	19,092	28,115	107,038
September 1951	2,925,570,545	6,472	13,565	20,037	146,008
October 1951	3,116,490,095	4,131	9,053	13,184	236,348
November 1951	2,939,503,144	2,022	4,405	6,427	457,368

Miscellaneous Publicatjons

REPORT ON THE ELEVATED-TEMPERATURE PROPERTIES OF STAINLESS STEEL (STP No. 124). Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, 120 pages; 8½ in. by 11; bound in heavy paper cover. Price, $4. This 1952 report has been prepared by Ward F. Simmons and Howard C. Cross of the Battelle Memorial Institute and issued under the auspices of the A.E.T.M.-A.S.M.E. Joint Committee on the Effect of Temperature on the Properties of Metals. It is essentially a graphical summary of elevated-temperature data for the commercially produced stainless steels. In-

cluded are summary curves for tensile strength, 0.2 per cent offset yield strength, per cent elongation, per cent reduction of area, stresses for rupture in 100, 1,000, 10,000 and 100,000 hr. and stress for creep rates 0.0001 and 0.00001 per cent per hour (1 per cent in 10,000 and 100,000 hr.) The data sheets in the Appendix give the chemical composition, processing data, and other pertinent information from which summary curves and charts were prepared.

TOOL STEEL HANDBOOK. *Allegheny Ludlum Steel Corporation, 2020 Oliver building, Pittsburgh 22, 197 page book, 7¼ in. by 10½ in.* This volume is intended as companion literature to previously published "Stainless Steel Handbook" and "Strength of Stainless-Steel Structure Members as Function of Design." The volume on tool steels begins with charts and tables giving specific and comparative data on properties, analyses and applications. Detailed descriptions of all important grades, alphabetically arranged, follow. Later chapters deal with the many forms and finishes of tool and die steels and such allied products as the sintered carbides marketed under the name of Carmet. The final sections comprise extensive discussions of heat treating and handling techniques as applied to tool and high-speed steels, weight tables, and other reference material.

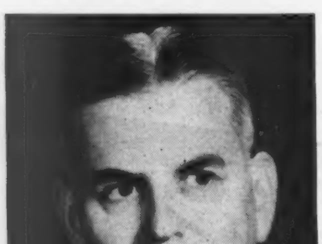
SUPPLY TRADE NOTES

NATIONAL SEATING COMPANY.—The National Seating Company, of Mansfield, Ohio, recently elected the following officers: President, *Robert G. Brooks;* vice-presidents, *J. E. Bingamon, C. A. Van Derveer, Jr.,* and *Bob Williams;* and secretary-treasurer, *W. A. Gustafson.* All were formerly connected with S. Karpen & Bros., in the sales and management ends of the transportation seating division.

◆

GENERAL MOTORS CORPORATION.—*Nelson C. Dezendorf* has been elected a vice-president of General Motors. Mr. Dezendorf is also general manager of the *Electro-Motive Division,* to which position he was appointed on February 26. *Paul R. Turner,* eastern regional manager, succeeds Mr. Dezendorf as director of sales of the Electro-Motive Division.

Mr. Dezendorf attended the University of Oregon and, after service in the Army



N. C. Dezendorf

during World War I, returned to the University of California to obtain a degree in engineering. He entered the employ of General Motors Acceptance Corporation at Portland, Ore., in May 1922, and became a vice-president of G.M.A.C. in 1931 and a director and member of the Executive Committee in January 1941. In October 1941 he relinquished these positions to become general assistant to the vice-president in charge of the distribution staff of General Motors. He later served for 18 months as director of GM's distribution staff in Detroit, and since June 1945 had been director of sales for Electro-Motive. Mr. Dezendorf was born in Portland, Ore., April 23, 1898.

Mr. Turner, who was born in Milan, Ohio, March 29, 1894, is a graduate of University School, Cleveland (1951). He

P. R. Turner

was in the national sales department of the White Motor Truck Company from 1918 until 1921. While establishing branch offices in Denver and Salt Lake City, Mr. Turner became associated with, H. L. Hamilton, wholesale sales manager for White, and the two men started the preliminary planning that led to the establishment of Electro-Motive in 1922. In 1925 Mr. Turner established the first Electro-Motive office in New York where he directed sales activities for Electro-Motive in the eastern half of the United States.

◆

BOGUE ELECTRIC MANUFACTURING COMPANY.—The Bogue Electric Manufacturing Company, 52 Iowa avenue, Paterson, N. J., has announced the formation of a Railway Equipment Division.

Several new products designed specifically for railroad applications will be marketed by the new division. In the railway car lighting field, the company will produce axle generators for passenger cars, rotary converters and motor generators for converting direct current to alternating current, engine-driven car lighting generators, voltage regulators and electric power distribution panels. Several types of automatic battery chargers also will be offered including units which may be permanently mounted under railway passenger cars as well as portable battery chargers for use at yards and terminals. For railroad communication and signaling applications, the division will distribute selenium rectifiers, power supply units and point-to-point radio communications equipment. The line will include "packaged" electric power systems for installation on railroad cabooses for powering radio communications equipment.

◆

WINE RAILWAY APPLIANCE COMPANY.—*E. G. Goodwin* has been appointed consulting engineer of the Wine Company. *Walter L. Floehr* succeeds Mr. Goodwin as mechanical engineer, and *E. G. Goodwin, Jr.,* has been appointed assistant to the mechanical engineer.

◆

STANDARD RAILWAY EQUIPMENT MANUFACTURING COMPANY.—*John A. Brossart,*

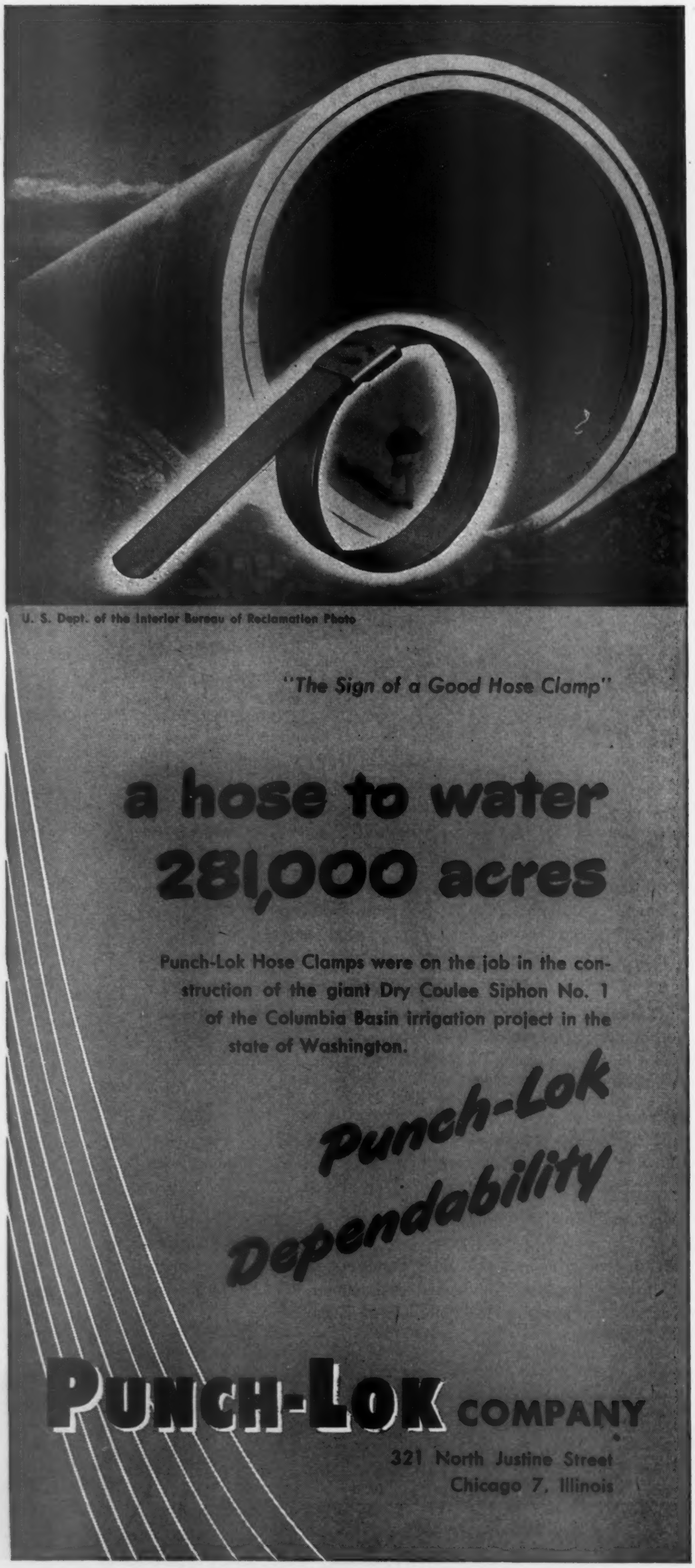
J. A. Brossart

Jr., has been appointed assistant vice-president in charge of production of the Standard Railway Equipment Manufacturing Company, at Hammond, Ind.

◆

ELECTRIC STORAGE BATTERY COMPANY.—*S. Wyman Rolph,* president of the Electric

(Continued on page 124)



Storage Battery Company, was elected president of the Franklin Institute at the recent annual meeting of the board of managers. Mr. Rolph succeeds *Richard T. Nalle*, president of the Midvale Company.

◆

NATIONAL MALLEABLE & STEEL CASTINGS Co. of Cleveland has contracted to purchase for cash all capital stock of the *Capitol Foundry Company* of Phoenix, Ariz., and its subsidiary, the *Arizona Iron Works*. Both companies will be operated as subsidiaries of National Malleable; *Edward A. Spring*. Capitol's president and general manager, will continue in the same capacity. A $1,500,000 program to expand and improve the Phoenix properties is being undertaken.

◆

CRUCIBLE STEEL COMPANY OF AMERICA.—*Richard C. Lawson* has been appointed assistant manager, railroad and spring sales department, of the Crucible Steel Company of America, with headquarters in New York. Mr. Lawson has been actively associated with Crucible's railroad sales department since joining the company in 1926. For several years he was located at the company's Chicago and Cleveland offices as a sales service engineer.

Richard C. Lawson

◆

TEMPLETON, KENLY & CO.—*Arthur Templeton*, formerly sales engineer in the Chicago area for Templeton, Kenly & Co., has been appointed southwestern divisional sales engineer, with headquarters at 6505 Aberdeen avenue, Dallas, Tex., to cover Texas, Oklahoma and Louisiana.

◆

CECO STEEL PRODUCTS CORPORATION.—*J. E. Grogan* has been appointed vice-president in charge of the eastern district for the Ceco Steel Products Corporation, of Chicago.

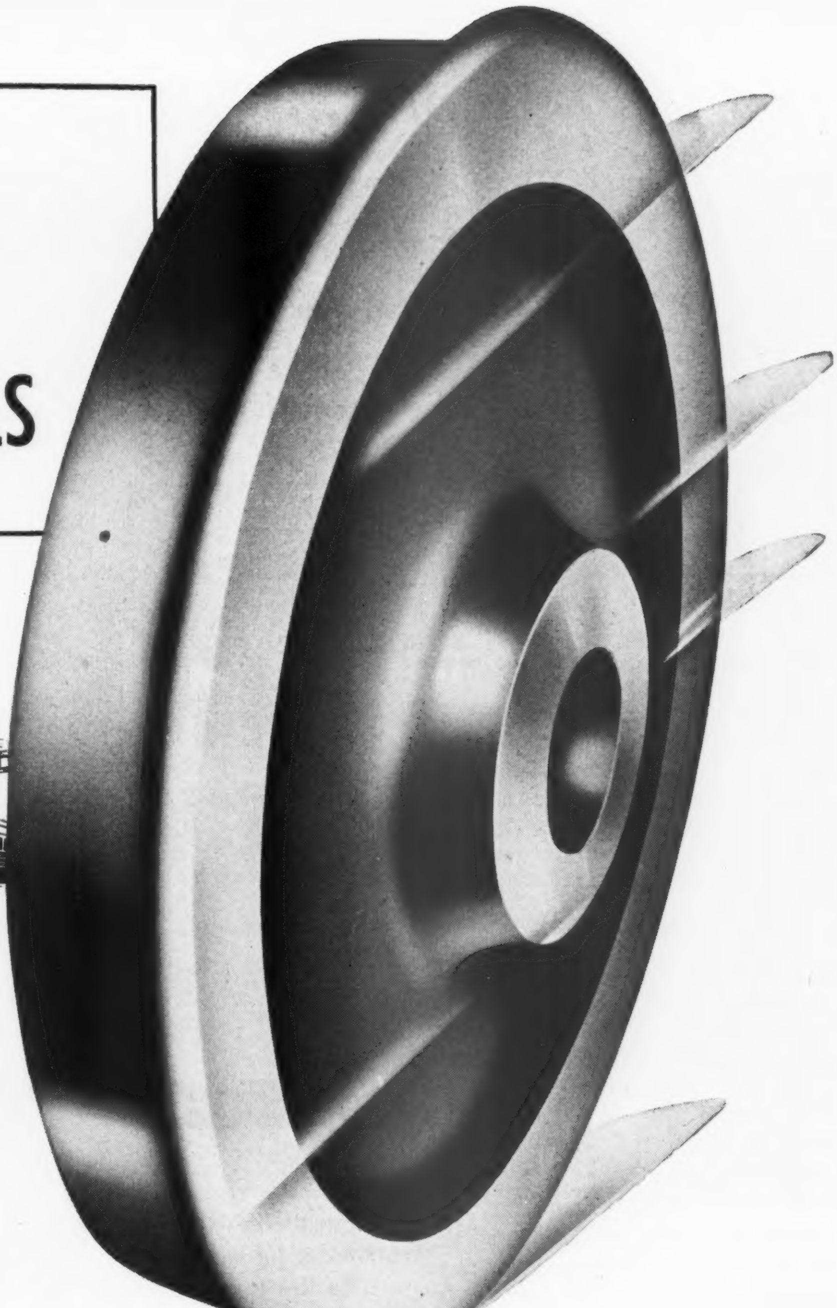
◆

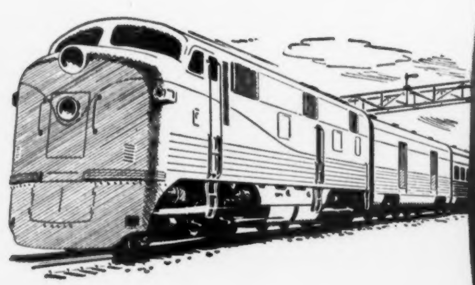
GRANDY RAILWAY EQUIPMENT COMPANY.—*D. R. Myers* has been appointed Chicago railway representative of the Grandy Railway Equipment Company, Cleveland, to succeed *F. W. Evinger*, who has resigned. Mr. Myers formerly was with the company's industrial and railroad department at Cleveland.

◆

BALDWIN-LIMA-HAMILTON CORPORATION.—*Walter A. Rentschler* has been appointed vice-president in charge of the

You can have confidence in ARMCO WHEELS





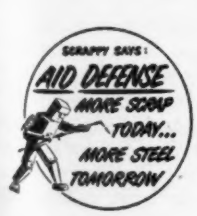
Today, more than ever, you want wheels that merit utmost confidence. Higher speeds mean quicker stops—and an increasing need for wheels that will withstand severe braking under passenger cars and the high and complex stresses imposed by Diesel service.

Here is why you can rely on Armco wheels. Sixteen years ago an intensive, permanent program of wheel research was set up. Since then, special laboratory tools have been developed to simulate—and even exceed—the most punishing service conditions.

For example, to study the effects of severe braking, one testing machine brakes a wrought steel wheel at 120 m.p.h. to a stop in 15 seconds, with 20,000 pounds of pressure on each brake shoe. Hundreds of such tests on wheels of different analyses and heat treatment have provided invaluable data.

This never-ending research work, along with the experience of 43 continuous years of wheel-making, is responsible for the present Armco Wrought Steel Wheel. Latest methods of quality control insure uniformity from wheel to wheel—offer you greater peace-of-mind.

It will pay you to investigate Armco Wrought Steel Wheels. Just get in touch with our nearest District Office or write us at the address below.



ARMCO STEEL CORPORATION

2122 CURTIS STREET, MIDDLETOWN, OHIO • PLANTS AND SALES OFFICES FROM COAST TO COAST • EXPORT: THE ARMCO INTERNATIONAL CORPORATION

ARMCO

Walter A. Rentschler

Eddystone Division of the Baldwin-Lima-Hamilton Corporation. Mr. Rentschler, who has previously been vice-president in charge of the Lima-Hamilton Division, will continue in charge of the Hamilton plant, which will come under the immediate supervision of *J. F. Connaughton*, who has been appointed general manager of the plant. The Lima Division will continue under the direction of H. F. Barnhart, who will report to M. W. Smith, president of the corporation.

◆

INTERNATIONAL NICKEL COMPANY.—A sound-color film entitled "Corrosion in Action," has been prepared under the direction of the Corrosion Engineering Section of the International Nickel Company, 67 Wall Street, New York 5. The film, in three parts of two reels each, shows how corrosion works to cause an annual loss in industry and elsewhere estimated at over six billion dollars. It also shows how this damage can be avoided or controlled by various means, such as by the selection of corrosion-resistant materials, by the development of new alloys to meet given situations, by the use of electric currents to provide cathodic protection, and by other methods. The film can be shown in one part, in any combination of two parts, or in the full three-part length, depending on the time available. Each part requires 20 min. showing time. Bookings can be made through the Corrosion Engineering Section of the company.

◆

NATIONAL BRAKE COMPANY.—The National Brake Company has acquired the assets of the *Champion Brake division of the Orme Company* of Chicago and Michigan City, Ind. National Brake will continue production and sale of the Champion-Peacock Micro-matic freight-car hand brake in addition to its line of Peacock power hand brake equipment for all other types of rolling stock.

◆

COMBUSTION ENGINEERING-SUPERHEATER, INC.—The business of the *American Throttle Company*, has been acquired by Combustion Engineering-Superheater, Inc. All matters pertaining to sales and service will, as in the past, be conducted by their Superheater Company Division. Orders for locomotive dome or front end throttles,

throttle masters, throttle levers, parts or other correspondence should be addressed to the Superheater Company, Division of Combustion Engineering-Superheater, Inc., 425 West 151st Street, East Chicago, Ind.

◆

GRAYBAR ELECTRIC COMPANY.—*R. B. Sayre* has been appointed assistant vice-president of the Graybar Electric Company,

R. B. Sayre

and *D. L. Harper* formerly branch manager at Omaha, Neb., will succeed Mr. Sayre as district manager at Jacksonville, Fla.

D. L. Harper

In his new post, Mr. Sayre will report to G. F. Hessler, vice-president in charge of sales at New York.

◆

C. RAYMOND AHRENS, INC.—*A. L. Sutherland,* formerly with Manning, Maxwell & Moore, has joined the sales department of C. Raymond Ahrens, Inc., as chief engineer, representing the company in the New York area.

◆

CUMMINS ENGINE COMPANY.—*John T. Weber* has been appointed manager, sales development, at Columbus, Ind., succeeding Howard P. Sharp, who has resigned.

◆

FAIRBANKS, MORSE & CO.—*J. W. Elwin* has been appointed sales representative of the diesel locomotive division in the Chicago area for Fairbanks, Morse & Co. Mr. Elwin formerly was with the Great Northern and later with the Chicago &

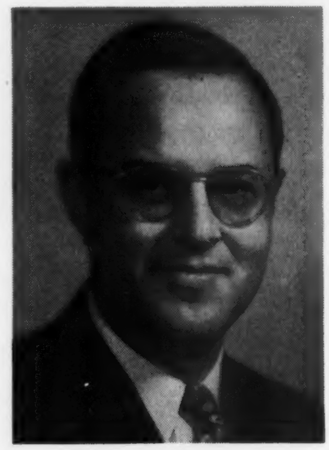
Eastern Illinois of Danville, Ill. C. E. Dietle has been appointed manager of the diesel sales division of Fairbanks, Morse.

Mr. Dietle started with the company as a salesman in 1926, spending several years in the Detroit and Toledo areas. He was transferred to Chicago in 1944, and was diesel department manager of the Chicago branch prior to becoming manager of the diesel sales division.

◆

UNION ASBESTOS & RUBBER CO.—*John F. Corcoran* has been appointed director of sales for the Union Asbestos & Rubber Co., with offices in Chicago.

Mr. Corcoran was associated with several investment and construction business firms

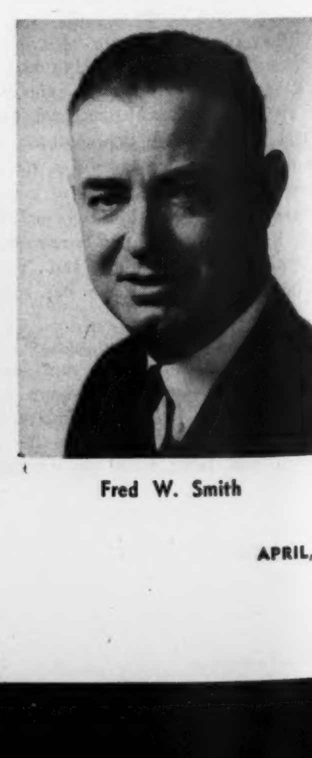


John F. Corcoran

before joining the American Locomotive Company in New York in 1940. He served that company at Washington, D. C., and Atlanta, Ga., and in 1948 was transferred to the Chicago office as assistant to the vice-president. In 1950 he opened his own office in Washington, and represented several firms in the railway supply industry, including Union Asbestos & Rubber, Standard Railway Equipment Manufacturing Company, Spring Packing Corporation, Peerless Equipment Company, and Pyle-National Company.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*Fred W. Smith*, sales representative for Railway Mechanical and Electrical Engineer and other railway publications of



Fred W. Smith

92 hrs. of heat treatment

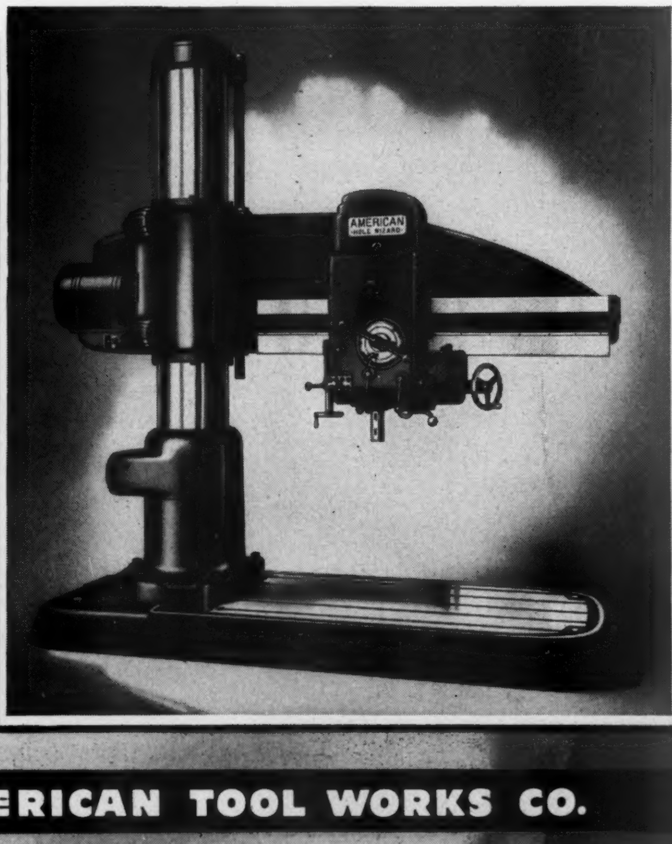
. . . required to produce the ultimate in radial drill spindles

"AMERICAN" Radial Drill Spindles are made of nitralloy. 20 hours of heat treatment from rough to finish, then 72 hours of nitriding are required to produce the wear-resistant spindles used in these radials.

Both the spindles and sleeves are nitrided to 110 degrees scleroscope. This is harder than some grades of cemented carbide. The sleeve is finish honed and the spindle ground and then diamond lapped to a sliding fit in the sleeve. Because of the lack of affinity between these two hard surfaces the clearance between them may be reduced to the very minimum, which in this case is .00025".

This results in the greatest possible stability, resulting in an ideal construction especially for accurate boring operations, which demand a high degree of smoothness and rigidity of the spindle.

This is but one of the super features that make the "AMERICAN" Hole Wizard an outstanding investment.



THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

the Simmons-Boardman Publishing Corporation, has been elected vice-president of the corporation.

Mr. Smith was born at Coal Valley Ala., on December 31, 1910, and received his education in structural engineering from the International Correspondence Schools. He entered railroad service in 1937 as a rodman-transitman for the Birmingham Southern at Birmingham, Ala., where he remained until 1941, when he became railroad engineer for Alford Burdick & Howson, consulting engineers, Chicago. In 1942 he joined the Chicago, Rock Island & Pacific as an engineer-estimator, and in 1945 became associate editor on the *Railway Engineering & Maintenance Cyclopedia*, a Simmons-Boardman publication. From 1946 to 1947 he was associate editor in the purchases and stores department of *Railway Age*, and in the later year was appointed sales representative.

◆

Fafnir Bearing Company; Waugh Equipment Company.—The Fafnir Bearing Company, of New Britain, Conn., and the Waugh Equipment Company, of New York, have jointly announced discontinuance of the manufacture and sale of Fafnir-Waugh railway journal bearings, because of the increasing demands of the defense program for ball bearings, Fafnir's major product, and a limit to available facilities for their production.

◆

Walter R. Collins Company and Collins Oil & Manufacturing Co.—*J. Donald Hadden*, Pittsburgh, has joined the Walton

J. Donald Hadden

R. Collins Company and the Collins Oil & Manufacturing Co. to handle Rust Oleum products and Hanlon & Wilson Company Bonds. Mr. Hadden formerly was with the Universal Cyclops Steel Company and also was production engineer with the United States Army Ordnance department.

◆

Peerless Machine Company.—*C. O. Wanvig, Jr.*, formerly secretary of the Peerless Machine Company, Racine, Wis., has been elected president, to succeed the

L. P. Thomas

late *J. R. McDonald*. *Lee P. Thomas*, has joined Peerless as sales representative at the company's general office at Chicago. Mr. Thomas was formerly with the Baldwin-Lima-Hamilton Corporation's transportation division.

◆

Quaker Rubber Corporation—*J. R. Lewis* has been appointed general sales manager of the Quaker Rubber Corporation, division of the H. K. Porter Company, Philadelphia.

Mr. Lewis has been with Quaker Rubber for more than 11 years and has been,

successively, Philadelphia district sales manager, assistant sales manager and assistant general sales manager. As general sales manager, he will be in complete charge of the sales organization of the company.

◆

DETREX CORPORATION—*P. W. Moehle* has been appointed sales manager of national accounts for the Detrex Corporation, Detroit 32.

◆

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY.—*Milton L. Edgren* has been appointed field service engineer in the transportation division of the Minneapolis-Honeywell Regulator Company, at Minneapolis.

◆

UNITED STATES STEEL COMPANY.—*John S. Ewing* has been appointed manager of stainless steel sales for the United States Steel Company at Pittsburgh.

Obituary

JOSEPH C. SNYDER, vice-president in charge of sales for the Pullman-Standard Car Manufacturing Company, died on February 17. Mr. Snyder began his business career in the New York Central's purchasing department. He later joined the Richmond Car Works, where he was subsequently appointed a vice-president. The Richmond company was acquired by the Standard Steel Car Company, of Pittsburgh, Pa., and the latter, in turn, by the Pullman Company to form the Pullman-Standard Car Manufacturing Company. Mr. Snyder turned his attention to sales for the newly formed company and was appointed a vice-president. He had charge of Pullman-Standard's Cleveland, Ohio, office from 1931 until his retirement in 1949.

◆

OLIVER S. LYFORD, 81, electrical engineer and consultant, who participated in the construction of Pennsylvania Station at New York, died on March 6, at Daytona Beach, Fla.

◆

T. M. FERGUSON, 67, New England sales and service representative for the Brandon Equipment Company, of Chicago, died on January 17.

PERSONAL MENTION

General

H. L. BULLOCK has been appointed superintendent of motive power of the Akron, Canton & Youngstown at Akron, Ohio.

J. E. POTTS, assistant to superintendent of motive power of the St. Louis-San Francisco, has been appointed assistant to chief mechanical officer, with headquarters as before at Springfield, Mo.

JOHN E. WIGHTMAN, JR., superintendent motive power-diesel, Central region, of the Pennsylvania at Pittsburgh, has been appointed superintendent of the Lake division with headquarters at Cleveland. Mr. Wightman a graduate of Lehigh University, entered the service of the Pennsylvania in 1928 as a draftsman at Philadelphia. He

John E. Wightman, Jr.

served successively as machinist, inspector foreman and master mechanic, until 1948 when he was named superintendent motive power of the Western Pennsylvania division. Mr. Wightman was appointed superintendent motive power—diesel, Central region, at Pittsburgh, on November 1, 1950.

C. H. LOCKHART has been appointed superintendent of motive power and car equipment of the Central Vermont, with headquarters at St. Albans, Vt.

H. A. SCHNITZ, engineer of tests of the Chicago, Rock Island & Pacific at Chicago, has taken a leave of absence.

J. W. ECKSTEIN, superintendent motive power and cars of the Akron, Canton & Youngstown at Akron, Ohio, has retired after 32 years of service.

J. E. TIEDT, engineer of water service and work equipment of the Chicago, Rock Island & Pacific, has been appointed engineer of tests, with headquarters in Chicago.

HARRISON L. PRICE, superintendent of shops of the Atchison, Topeka & Santa Fe, at Albuquerque, N. M., has been appointed mechanical assistant at Chicago. Mr. Price entered Santa Fe service as a machinist apprentice at Topeka, Kan., in 1916. He was successively clerk, machinist, engine inspector, apprentice instructor, welder, test department assistant, car gang foreman, air-brake foreman, and acting superintendent of Chicago car works, until his appointment as superintendent Chicago car works in 1941. He became master mechanic at Chanute, Kan., in 1943, and in April of that year master mechanic to Chicago, where he served until 1949, when he was appointed superintendent of shops at Albuquerque.

MAX C. HABER, general mechanical engineer of the Union Pacific at Omaha, has assumed the duties of research and standards engineer, at Omaha. Mr. Haber is a graduate of the University of Nebraska, with a degree in mechanical engineering. He joined the U.P. in 1922 as a tracer, and has served as draftsman, engineer of road tests and mechanical engineer.

HOWARD H. MELZER, assistant mechanical engineer of the Chicago, Milwaukee, St. Paul & Pacific at Milwaukee, has been appointed mechanical engineer. Mr. Melzer started with the Milwaukee in 1936 following graduation from Marquette University where he received the degree of bachelor of civil enginering. Subsequently he has been production engineer, dynamometer engineer, assistant engineer of tests, and since 1949, assistant mechanical engineer.

J. A. LONG wrecking engineer of the Seaboard Air Line, has been appointed foreman of the car and locomotive department at Monroe, N. C.

D. M. BRESSETTE has been appointed mechanical engineer of the Central Vermont at St. Albans, Vt.

FRANK FAHLAND has been appointed general mechanical engineer of the Union Pacific at Omaha. After graduating from the University of Minnesota college of engineering, Mr. Fahland served as a draftsman for the Northern Pacific in 1923. He joined the U.P. in 1936 as assistant engineer of design and material.

L. H. BEXON has been appointed director of training in the mechanical department of the Canadian National. The duties of Mr. Bexon who was formerly supervisor of apprentice training, have been extended to include supervision over all training and educational programs in the mechanical department as well as diesel training.

Diesel

E. H. DAVIDSON, JR., has been appointed diesel supervisor of the Akron, Canton & Youngstown.

G. R. WEAVER, master mechanic, Maryland-Delmarva division of the Pennsylvania at Wilmington, Del., has been appointed superintendent motive power-diesel, Central region, with headquarters at Pittsburgh.

Electrical

J. W. LUKE, day diesel enginehouse foreman of the Atchison, Topeka & Santa Fe at Argentine, Kan., has been appointed general supervisor of diesel engines at Chicago.

(Turn to page 140)

Shop and Enginehouse

J. B. Roman, special engineer for the Chesapeake & Ohio at Richmond, Va., has been appointed shop engineer at Richmond. Mr. Roman was born in Bradley, Ohio, on February 15, 1908, He received his B.S. in M.E. at the University of Pittsburgh in 1931, and from June 1924 until July 1931 was variously employed as a coal loader; as a tile and terrazo setter helper; in the repair and testing and electrical equipment; as an instrument man and coal and coak sampler; as an inspector of automobile motors, and as a physical tester in an airplane plant. He then began service with the C. & O. as a special apprentice at Huntington, W. Va. In November 1936 he became an assistant in the physical testing laboratory at Huntington; in May 1937 material supervisor at Richmond; in August 1941 pattern supervisor; in September 1944, special engineer; in June 1949 acting shop engineer, and in November 1949 special engineer. Mr. Roman, on leave of absence from the C. & O., was mechanical consultant for the Orinoco Mining Company at New York from January 1951 until April 1951. He then returned to Richmond as special engineer for the C. & O., and in July 1951 was appointed acting shop engineer.

J. B. Roman

R. F. Dollard shop engineer of the Chesapeake & Ohio at Richmond, Va., has retired.

D. J. Everett, master mechanic of the Atchison, Topeka & Santa Fe at Galveston, Tex., has been appointed superintendent of shops, at Albuquerque, N. M.

Master Mechanics and Road Foremen

H. J. Scholz has been appointed road foreman of engines of the Michigan Central district of the New York Central at Detroit.

(Turn to page 142)

Master Mechanics and Road Foremen

(Continued from Page 140)

KENNETH J. ICKES has been appointed assistant road foreman of engines, Michigan Central district, of the New York Central at Jackson, Mich.

F. H. RUSSELL, road foreman of engines of the Michigan Central district of the New York Central at Detroit, has retired after 49 years of service.

L. A. DIXON, assistant master mechanic of the Fort Wayne division of the Pennsylvania, has been appointed master mechanic of the Susquehanna division, with headquarters at Williamsport, Pa.

E. H. LEWIS, assistant road foreman of engines of the Fort Wayne division of the Pennsylvania, has been appointed assistant road foreman of engines, New York division.

J. H. KERVIN, general foreman for the Chicago, Milwaukee, St. Paul & Pacific, at Chicago, has been appointed master mechanic of the Rocky Mountain division, with headquarters at Deer Lodge, Mont.

L. L. LUTHEY, general supervisor of diesel engines of the Atchison, Topeka & Santa Fe at Chicago, has been appointed master mechanic at Galveston, Tex.

W. E. BRAUTIGAM, master mechanic of the Chicago, Milwaukee, St. Paul & Pacific at Deer Lodge, Mont., has retired.

A. R. MARSH, master mechanic of the Susquehanna division of the Pennsylvania at Williamsport, Pa., has been appointed master mechanic of the Maryland-Delmarva division, with headquarters at Wilmington, Del.

Electrical

J. J. MILLER, mechanical and electrical superintendent of the Niagara, St. Catharines & Toronto (Canadian National) at St. Catharines, Ont., has been appointed electrical superintendent, St. Clair Tunnel, at Port Huron, Mich.

Car Department

RAYMOND KNORR, division car foreman of the Erie at Marion, Ohio, has retired.

C. E. MATTHEWS, supervisor of the car department of the Seaboard Air Line at Hamlet, N. C., has been appointed foreman of the car department at Baldwin, Fla.

HAROLD D. MCCONAHY, division car foreman of the Erie, at Meadville, Pa., has been transferred in the position of division car foreman at Marion, Ohio.

P. A. GANTT, foreman of the car department of the Seaboard Air Line at Baldwin, Fla., has been appointed supervisor of the car department at Hamlet, N. C.

F. F. LENTZ, superintendent of the Akron, Canton & Youngstown at Akron, Ohio, has assumed supervision of the car department in addition to his duties as superintendent.

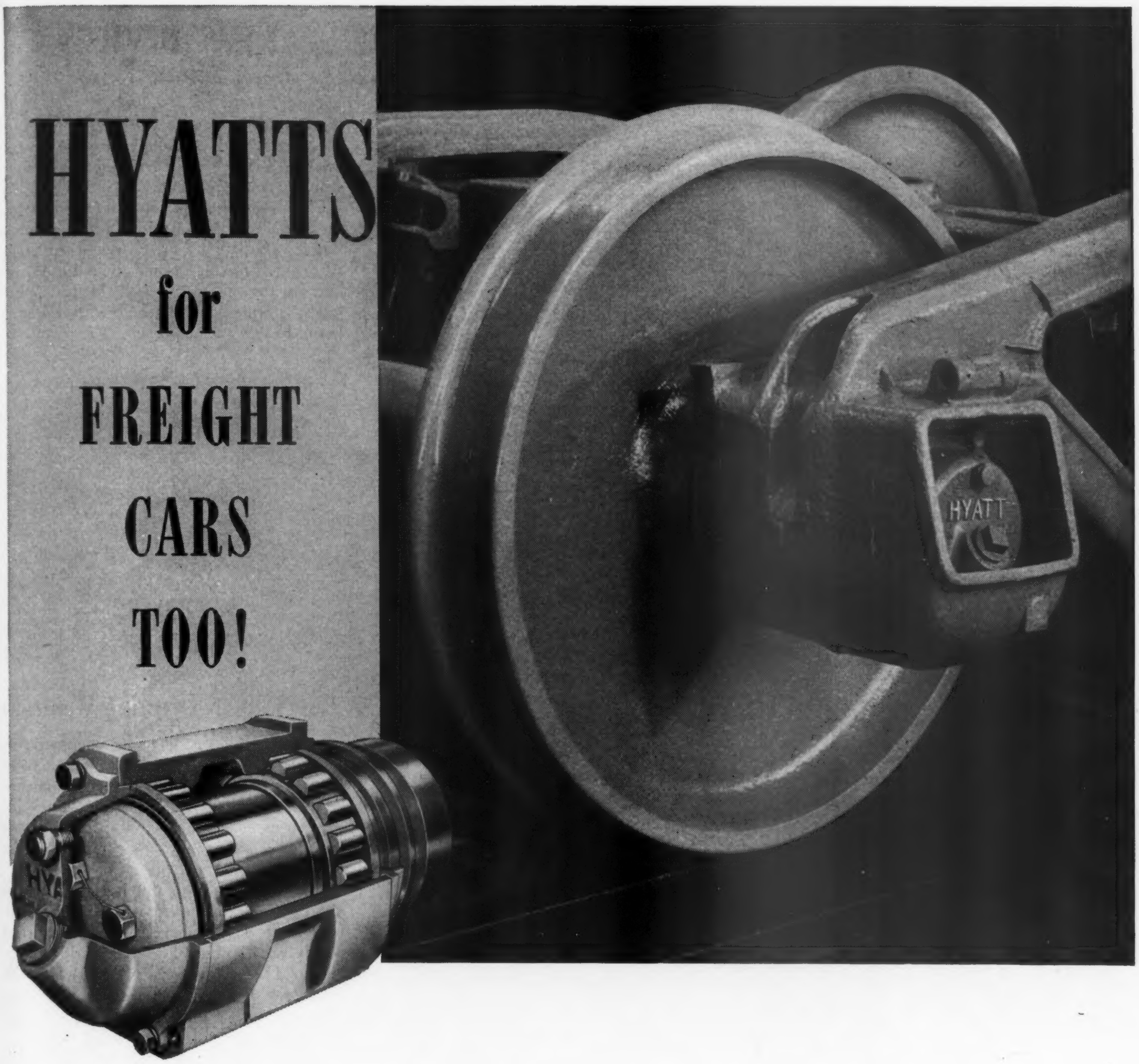
ROY RADFORD, general foreman of the car department of the Seaboard Air Line at Hamlet, N. C., has retired.

H. B. PARDUE, supervisor car department of the Seaboard Air Line at Raleigh, N. C., has been appointed general foreman of the car department at Howells, Ga.

R. H. STUBBERFIELD, general foreman of the car department of the Seaboard Air Line at Atlanta, Ga., has been appointed general foreman of the car department at Hialeah, Fla.

Obituary

W. D. TAYLOR, 49,, electrical engineer of the Central region of the Canadian National at Toronto, Ont., died on February 20. Mr. Taylor was an active member of the Electrical Section of the Association of American Railroads. He was born at Ottawa, Ont., on December 18, 1902, and attended McGill University (B.Sc. 1927). He entered railroad service in 1927 as electrical inspector on the C.N., and was appointed assistant electrical engineer in 1929. Mr. Taylor was engaged in sales engineering and general engineering, railway and industrial equipment, from 1931 to 1946. In the latter year he became electrical engineer of the Central region of the C.N.



Railroad men tell us that, eventually, freight cars must be moved at passenger train speeds, at lower cost, with less damage to lading and with fewer delays due to hot boxes.

Roller Bearing Journal Boxes for freight cars can do as much to speed up freight schedules as they have done for passenger service. Demands for speed, safety and passenger comfort have made roller bearing equipment a "must" for passenger cars and diesel locomotives.

The same problems that faced railroads and roller bearing manufacturers when early passenger cars were changed from plain bearings to roller bearings are present today in the freight car field but years of experience finds us much better equipped to face them.

For further information write to Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARING JOURNAL BOXES

NEW DEVICES

(Continued from page 113)

the No. 751 cleaner with two parts of water was then pumped through the exchanger. Heat was maintained through steam at 140 deg. F.

This solution was circulated for 8 hr., then discarded and a fresh solution pumped through for 10 hr. in a reverse direction. At the end of this period, the solution was left in the exchanger for 14 hr. When finally drained and flushed with water, a clean system was obtained.

◆

New Thor Impact Wrench

A new Thor ⅜ in. portable pneumatic reversible impact wrench, recently announced by Independent Pneumatic Tool Company, Aurora, Ill., features the same basic impacting mechanism as the universal electric impact tools made by this company for industrial and railroad use.

Exceptional power and long service life are credited to an exclusive rolling ball-type cam which increases efficiency and steady functioning of the impacting mechanism. The new wrench is available with two types of spindles having ½ in. square drive, or a 7/16 in. hexagon quick-change chuck integral with the spindle.

The wrench weighs only 5¾ lb. and is 8 11/16 in. long. A reversing valve is conveniently located at the back of the tool which can be equipped for either vertical or horizontal suspension on assembly lines.

An air motor transmits power to the impact mechanism through a torque-increasing planetary gear system. All heat treated alloy steel gear elements, precision finished, are mounted in full anti-friction bearings, providing extra power for heavy service and long life. Drawing loads and quick run-down of the nuts are easily accomplished for types of screw fastenings.

Additional features include extra large rotor pinion and idler gears, easily-operated throttle control, comfortable hand grip, self-contained oil reservoir which automatically meters exact lubrication requirements of tool and rota-type impact jaws.

◆

Bearing Lubricant

An improved multi-purpose grease for use in general industrial applications—Texaco Multifak 2 Grease—has been introduced by the Texas Company, New York. It

(Continued on page 150)

"Tycol Diesel Oils give smooth performance... assure top engine service"

Absolutely correct! Tycol Diesel Oils are a must for satisfactory lubrication. Their degree of refinement – their service endurance – and their high stability mark them outstanding.

Tycol Diesel Oils have more than proved themselves after years of operation in Diesels of every description and in all types of service . . . from high-speed units for industrial, railway and marine uses where a heavy-duty or detergent oil is necessary to low-speed Diesels where a non-additive lubricant can be used. Yes, sir, there is a Tycol Diesel Oil scientifically engineered for every Diesel application – engineered to do the job better . . . at lower cost.

Your nearby Tide Water Associated office will be glad to give you complete information. Wire or phone today.

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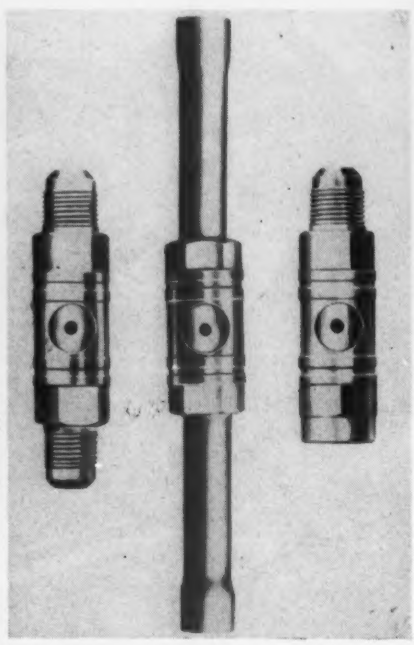
NEW DEVICES

(Continued from page 144)

is recommended for use in situations which require one high grade multi-purpose grease for a variety of operations.

Research officials responsible for the new formulation point out that Multifak has excellent shear stability, outstanding resistance against water washing, and good pumpability at low temperatures. It is highly suitable for bearing lubrication over a wide range of temperatures and can be used efficiently for an extensive variety of industrial lubrication jobs.

◆



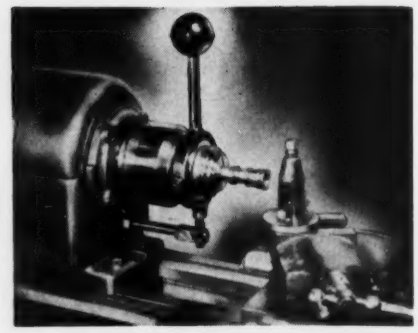
Flow Line Indicator

A visual flow line indicator is now available which is incorporated into the line and permits instant inspection without reading pressure gauges. Known as the Liquid Eye, this indicator manufactured by the Allin Mfg. Co., Chicago 22, consists of a brass housing in which is inserted a transparent high pressure Pyrex tube with a ceramic eye. This eye visually magnifies when the liquid line is full. Construction is such that it is not affected by commonly used chemicals, solutions and oils.

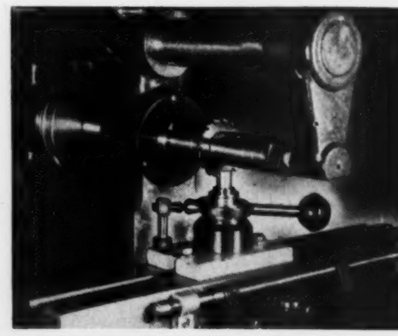
Assembly is completed with torque wrenches to secure uniformity and the indicator is so light in weight that there is practically no fatigue factor in the liquid line. Each unit is tested under conditions which simulate a pressure surge when a valve is opened.

These indicators are practical in boiler feed water conditioner lines, in oil pressure lines, diesel fuel lines, refrigerant and other chemical lines, where a positive check of flow is required.

Three styles are available in copper tube sizes of ¼, ⅜, ½ and ⅝ in. with male flare ends, female to male flare ends with copper flare insert in the female end, or with solder connections.



The Davo draw collet chuck accommodates all round, square, hexagonal and plain or serrated type draw collets



The Davo collet chuck in use on a standard milling machine

Draw Collet Chuck

The Davo Collect Chuck is designed for adaption to any model lathe, as well as to drill presses, grinders and milling machines. It has a simple opening and closing lever action which permits loading and unloading while the lathe is in motion. Any type spindle stop may be used in the lathe, and the collet will not move from permanent gripping operation due to a special feature known as the permanent stop. The lathe above the spindle bore may be employed for second operation uses.

A pair of fingers on the chuck housing which act to lock the workpiece in place also eliminate wearing the clutch bushing in the same spot from constant opening and closing. The collet threads are claimed to last longer because forcing is not necessary to tighten the collet in gripping position.

The chuck is made from hardened and ground alloy steel, and accommodates round, square, hexagonal and plain or serrated draw collets. It has no bearings, washers or retainers, and hence requires no lubrication.

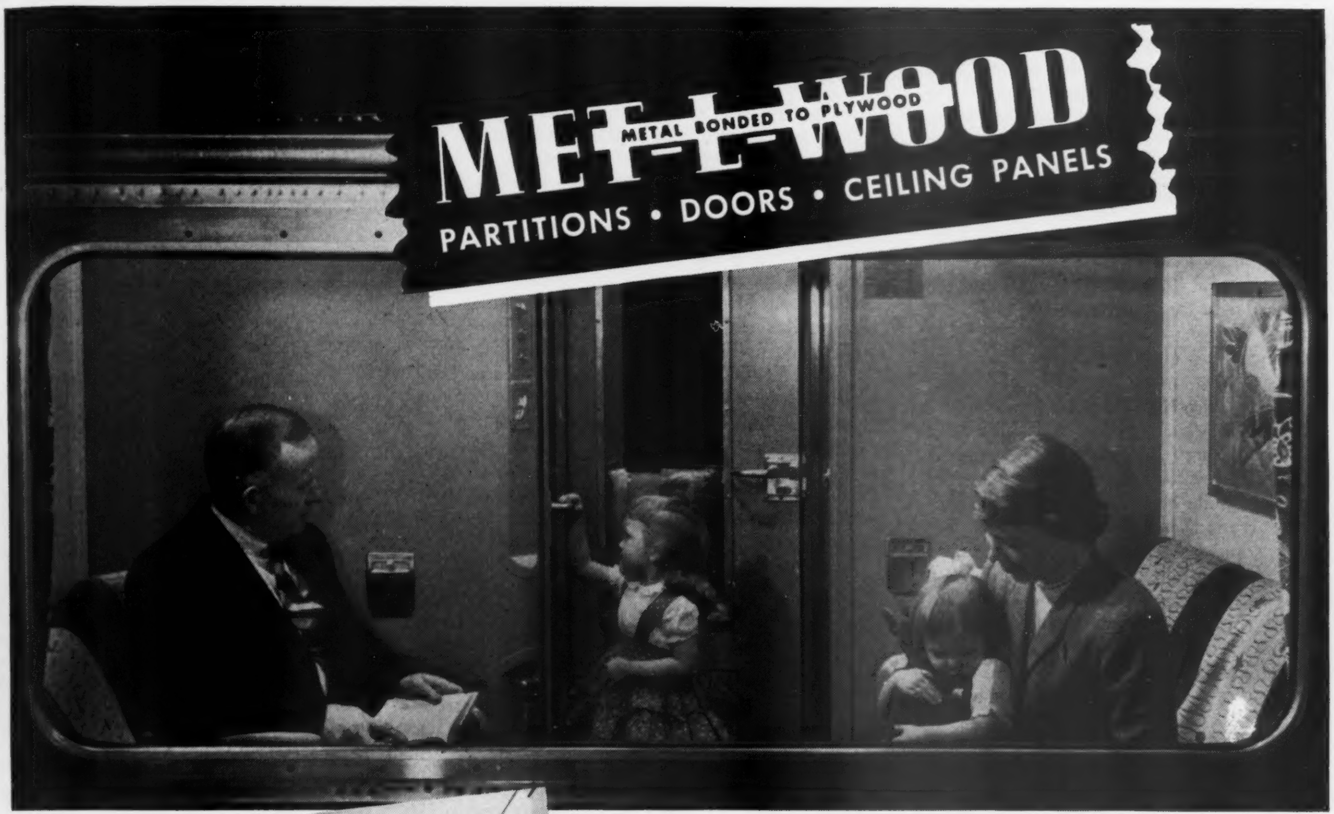
The Davo collet chuck is available in five sizes from the Stallion Manufacturing Co., 2017 N. Halsted street, Chicago 14. Capacities of the smallest sizes are $\frac{1}{16}$ to ½ in., the largest size, $\frac{1}{32}$ to 1¾ in.

◆

Mica Insulation for Traction Motor Coils

Mica mat, a paper-like material, made of matted flakes of mica, is being used for ground insulation in the General Electric Company's Locomotive and Car Equipment Department at Erie, Pa.

Developed in Europe, mica mat is manufactured by G.E. in a newly-adapted proc-



Above—Two views of Drawing Rooms in The Morning Congressional, The Senator and The Afternoon Congressional cars, showing Met-L-Wood doors, partitions and trim.

in Budd-Built Passenger Cars for Pennsylvania Railroad's New "Congressionals" and "Senator"

● Met-L-Wood used in the Pennsylvania Railroad's Budd-Built passenger cars for The Morning Congressional, The Senator and The Afternoon Congressional has these important advantages for builders, railroads and passengers:

Fabrication with Met-L-Wood is fast . . . Prefabricated doors, partitions and panels simplify assembly and save labor costs . . . and standard Met-L-Wood panels can be drilled, sawed, tapped or routed without special tools.

Lighter weight, as compared with equivalent all-steel construction, reduces overall car weights, lowers gravity centers—makes for lower operation and maintenance costs.

Inherent beauty of Met-L-Wood is backed by vibration damping, sound deadening and insulating qualities to add to passenger comfort in smart, modern surroundings.

Details on Met-L-Wood uses in passenger cars, baggage cars and cabooses will be furnished promptly on request.

MET-L-WOOD CORPORATION

6755 West 65th Street, Chicago 38, Illinois

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ess similar to paper making. General Electric engineers state that the operation at Erie is one of the first American production uses of this type of ground insulation.

Mica mat is being used in both armature windings and field coils in the manufacture of some motors and generators for electric and Diesel-electric locomotives at Erie.

This material will stand about 600 volts per mil of thickness. Its thickness is uniform within a fraction of a mil, and the thickness of a taped or wrapped conductor is now more constant than was possible with mica-glass cloth insulation. Engineers point out that mica mat also has fewer electrical "holes" than mica-glass cloth.

The manufacture is done by baking mica at 700-800 deg. C. and then suddenly quenching it with cold water, causing the mica to explode into tiny flakes. The water-mica slurry is then fed into a paper-making machine and comes out as a dry, fragile paper. This paper is impregnated with a heat-resisting silicone varnish and applied to glass cloth for use as wrappers. The finished product meets the specifications of Class H insulation.

◆

Aluminum Lamp Bases

The General Electric's Lamp Department is now using aluminum instead of brass for a large portion of its output of bases for incandescent electric light bulbs. Aluminum is being employed to conserve the scarcer brass for the nation's military needs.

The aluminum-based lamps are said to be identical in life, efficiency and cost to the familiar brass-based lamps. The new bases have the advantage of being resistant to tarnishing, and of maintaining a better appearance.

Adaptation of aluminum for lamp bases is considered by the aluminum industry to be one of the most important recent developments in the application of this metal. It is the outgrowth of several years' research and development by metallurgists of General Electric, major aluminum producers, and solder manufacturers.

In 1947, considerable work was done in the development and testing of aluminum for bases for fluorescent lamps, and in 1948, this metal was made the standard for all fluorescent lamp bases. During the same period, and thereafter, investigations were going on with the hope of later using aluminum for incandescent lamp bases.

The successful use of this metal for incandescent bulbs required an aluminum alloy which would withstand the high temperatures used by machines on which lamps are assembled. It also required the development of a solder and a flux suitable for a high-speed automatic soldering operation. This operation involves attaching to the shell of the base a wire which leads to the filament.

In addition, it was necessary to make exhaustive tests concerning such matters as electrolytic corrosion in brass and copper sockets, corrosion characteristics in various atmospheres, and contact resistance between the base and socket.

Development of the corrosion-resistant aluminum alloy, a special flux and a solder in wire form now for the first time makes the use of aluminum bases practicable.

In addition to maintaining a better appearance than brass bases, the aluminum boasts such advantages as having excellent electrical properties, being two and one-half times as good a conductor of electricity, and having greater resistance to acids and a variety of atmospheres.

It is expected that aluminum may become the standard metal for most lamp bases whenever the metal supply situation returns to normal. Until that time arrives, both brass and aluminum probably will be used.

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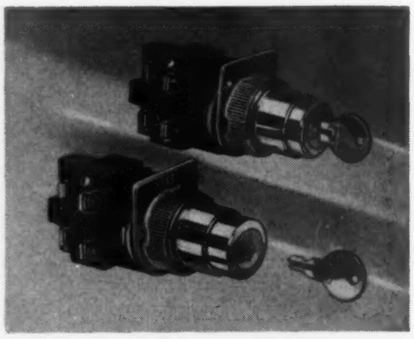

Key-Operated Pushbuttons

Key-operated cylinder-locks for oil-tight pushbuttons are available from the Westinghouse Electric Corporation. The locks come in two basic types: the selector switch, which has either two or three rotary positions; or the pushbutton type, which can be depressed in either full or intermediate positions. Several models cover virtually all possible conditions. For example, the pushbutton type allows the key to be removed in the depressed position, in the undepressed position, or in both; and, similarly, the selector-switch type allows the key to be removed in any one or all of the various positions.

The cylinder locks are mounted in place of the standard operator on Class 15-022 Oil-Tite pushbuttons for panel mounting, or in surface-mounting or flush-mounting stations. All operators of the complete Oil-Tite line are mounted in identical round holes in panels varying in thickness from 1/16 in. to 1/4 in. without requiring an extra gasket.

The single- or double-pole contact blocks can be mounted either in the bottom of the box or on the operator.